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THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

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☞ An asterisk (*) denotes an illustrated article

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WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS*, or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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TO OUR SUBSCRIBERS AND PATRONS.

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THE GAS INTEREST AT THE CENTENNIAL.

It is with great pleasure that we are enabled to place before our readers a definite plan for securing the representation to which the gas interest is entitled at the Centennial Exhibition this year. The way by which it is proposed to accomplish this is set forth in the following circular. The American Society of Civil Engineers have secured, as we are informed, ample space to give a full illustration of the progress in all its branches of the science of engineering in this country for the past 100 years. When we reflect that no such thing as a gas works existed in 1776; and that now this country has nearly a thousand of them certainly some progress ought to be shown.

We trust that there will be a general and hearty response to the call now made. The name of the Chairman of the Committee having immediate charge of this matter is sufficient guarantee that whatever is committed to their care will be properly looked after and arranged. If any gas engineer has an old drawing of the small beginnings of some of our works we trust that he will not hesitate to notify Col. Armington, and as soon as the time comes, forward the same. We trust that the interest in this matter may be so general that a full display, and one worthy of the fraternity, will be made:

CENTENNIAL COMMISSION.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

4 EAST TWENTY-THIRD STREET,
NEW YORK, February 2d, 1876.

SIR:

It is of much importance to the gas interests of this country, that a representation of the progress of gas-lighting in America during the past century, should be made at the Centennial.

American engineers, superintendents and contractors of gas-works, desiring to contribute plans, models or drawings of gas-works or gas machinery, are respectfully notified that their contributions will be received and taken charge of by the committee of the American Society of Civil Engineers, and placed in the portion of the Centennial Buildings set apart for that purpose.

If you have plans, drawings or models you wish to contribute, please notify the undersigned at the earliest possible moment, and oblige,

Respectfully,
JAMES H. ARMINGTON,
Chairman Sub-Committee XIV,
City Gas Co., Brooklyn, N. Y.
—Or at Rooms of the Society.

GAS FOR HEATING PURPOSES.

The *Jour. of Gas-Lighting*, of Jan. 4th, contains a full abstract of a paper read before the Society forthe Promotion of Scientific Industry, by Mr. John Wallace, of Newcastle-on-Tyne, on "The Combustion of Gas and the Theory and Structure of Flames." The most interesting and what seems to us the most important part of the paper practically is the application of heat from ordinary gas for mechanical and domestic purposes. There is no subject of more vital importance to the gas manufacturer than this, and if there can be devised an economical method of utilizing the great convenience and cleanliness of gas for heat-purposes, it will be a great blessing to humanity. There are so many objections to the ordinary fire, especially where the amount required at one time is so small as not to require a special fire-proof construction, that the wonder is that more progress has not been made in producing a good apparatus for heating by gas. No one doubts the ability of the gas profession to accomplish this if they would only take the matter seriously in hand. And why should they not do it? Is there really any good and sufficient reason why apparatus cannot be devised to use gas in mechanical and domestic operations to such an extent that the day consumption would equal if not exceed that of the night. It is not necessary to enter into a calculation as to the average length of the evenings when gas is burned for illuminating purposes. It would seem evident that the ordinary hours of labor would exceed those between the close of labor and the beginning of rest. Certainly the cost of distribution through the same pipes would be no greater in delivering gas for 24 consecutive hours than for 12, while the daily make would be much more uniform. An increased consumption should diminish the proportionate cost of manufacture, and it can not be denied that large sales at moderate profits is the true business maxim. Make the consumer feel that he gets what he pays for both in quality and quantity, and he will take something else to grumble about. As it is now it is a very prevalent fashion to grumble at gas companies, but let them increase their usefullness by improving the condition and the economy of the work-shop and the kitchen, and there will be much less cause or occasion for this. Perhaps at the present price of gas and coal there may not be so much saving in the use of the latter by the mechanical arrangements we now have. But in England they are following this matter closely and some of the

facts given by Mr. Wallace show that there is economy in the use of gas. He exhibited a gas furnace with 12 burners which had been in use for some time beneath a steam boiler and raised the steam to drive 3 printing presses at a cost of 7 cents per hour. We give in his own words a description of the arrangement: "I have here a gas furnace of 12 burners, each 1 inch in diameter, fixed on a flat cast-iron box, which supplies them all with gas." * * * *

The products of combustion, after passing upwards through the tubes of the boiler, are carried by a jacket down the outside, and escape by a flue at the base of the boiler, thus making the whole service available for heating. This arrangement also renders a damper unnecessary, as the speed of the draught is due to the difference of the temperature of the hot gas ascending in the tubes and those descending in the jacket. Since this furnace was used, the tubes have never required to be swept; a most satisfactory testimony to the completeness of the combustion. Previously, when another furnace was used which depended on the chimney draught, the whole heating surface had to be swept at regular intervals.

Among the useful applications of the heating burner, the gas stove is one of the most important. It is to be found wherever gas is used, and in spite of many real or imaginary objections, it is steadily making its way into public favor.

A very simple method is given by which the supply of gas is regulated by the temperature of the room itself. An automatic regulator is made as follows: A thin copper vessel of a certain capacity contains the air which by its expansion is to regulate the gas supply. There is a small valve on the top of this. A small pipe leads from the copper vessel to one end of an inverted syphon containing mercury, the other end of which has within it a bell-mouth tube suspended over the mercury at about one-eighth of an inch from its surface. The gas to be burnt enters this end of the syphon over the mercury, up the bell-mouthed tube thence through a pipe to the burners, where there is a small jet constantly burning from a supply independent of the bell-mouth. As the expansion of air in the closed vessel acts on the mercury in one leg of the syphon it depresses it and raises it in the other, thus reducing the space between the bell-mouth and the mercury, and if the air continues to expand it will close it entirely. These instruments have been so successfully adjusted that a change of 2° in temperature will make them work—adjusting, extinguishing and relighting the burners as heat may be required for weeks or months together. This is a very simple contrivance and what has ever been devised that can compare with it as a regulator for a boiler fire, certainly no coal fire can be so self regulating as this. How many small shops are there where steam power would be used if it were not for the trouble of having to have too much fire to run the engine. As to all cooking operations, gas, when properly applied, has many advantages, and we can not better express what should be said on this point than by using Mr. Wallace's own words, which we will give in full in our next issue.

EARLY EFFORTS IN GAS LIGHTING.

Through the kindness of a member of the New England Society of Gas Engineers we have been presented with a copy of the *Columbian Phenix*, issued at Providence, R. I., on November 13th, 1813. It contains several columns of reading matter which are interesting as reflecting the sentiments of the times. But as usual with all good newspapers we find items of interest in its advertising columns, one of which we reproduce *verbatim et literatim* as matter of historical interest in the gas world (see page 77). In vain are the papers of the day searched for further information on the subject matter of the advertisement, as though an experiment of that kind could not be safely commented upon. Of one fact we are assured, that Mr. Melville did make gas from "Pit Coal," and as early as 1806 he lighted his own house, and the street on which he lived in Newport with the same. We are further informed that for two years he lighted the light house on Beaver Tail with gas made from resin.

But he commenced his operations so near New Bedford, the headquarters of the oil business, that the contractors for supplying the government with oil quietly stepped in and put out his light. And so history repeats itself. Oil *versus* gas and gas *versus* oil—sometimes one is ahead and sometimes the other; now you see the gas-light and now you see the oil lamp.

LITERARY NOTICES.

THE POLYTECHNIC REVIEW.—No. I., vol. 1.—Devoted to Science as applied to the useful Arts, comes to us with a very cheerful appearance. It is edited by Wm. H. Wahl, Ph. D. and Robert Grimshaw, Ph. D., names that are a good guarantee of the character which may be expected to develop in its publication. It is clearly and neatly printed on good paper and contains a series of articles which will be found of interest among which are the following: Works now constructing at the Mouth of the Mississippi—Lowe's Gas Process—Metric System of Weight and Measures—Extracts from Wrigley's Reports on Production of Petroleum, together with many items of scientific and practical interest. We bespeak for the new enterprise a goodly share of the public favor, and, being published in Philadelphia, no doubt it will give due notice of subjects of scientific interest in connection with the Centennial.

Keep the Journal on File.—See our advertisement for New Binder. Price $1.25

[Original Communication.]
WRITTEN FOR THE AMERICAN GAS-LIGHT JOURNAL.

The Use of Coke Screenings as Fuel.

MR. EDITOR:—In accordance with your wish expressed to me some time since, I have overhauled some of our fuel accounts and selected such facts as may be of interest to men like myself engaged in the manufacture of gas. The figures that I give are, I believe, reliable and are taken directly from the books of the company as they are made up every month. The facts that I give in connection therewith are simply my own personal experience, and the results are such as I think would warrant any manager of a gas works in looking into the subject and if the saving of coke is any object I would not hesitate to recommend the adoption of this method of running boiler fires. By coke screenings we understand all the dust from coke, &c., that results from the screening of coke before its delivery on sale. It is our practice to screen all our coke after it is cooled down. The coarser portions of course may be gathered up by means of coke shovels or forks, but much that is left after this operation may be made available for "coke sales" by screening. The portions that fall through the screen are piled by themselves for use under the boilers. For many years and in fact until about three years ago we had used coke alone as fuel, when the burning of breeze was commenced. To show the saving to be derived from the latter I have taken the months of January for the past three years as an example of the use of screenings and the same months for the three years previous to that for that of coke.

USING COKE.

January,	1871	155	chaldrons.
"	1872	133	"
"	1873	111	"
Total		369	
Average per month.		133	" =4,788 bushels.

USING SCREENINGS.

January,	1874	126	chaldrons.
"	1875	123	"
"	1876	90	"
Total		399	
Month's average		113	" =4,068 bushels.

Saving in bushels.... 720 "

The average weight of our coke is 41 lbs. p. bush. The average weight of our screenings is 43 lbs. per bushel.

The coke being measured "heaping" and the breeze being always a "struck" bushel.

Reducing our bushels to pounds we have
Of coke.....196,308 lbs. =133 bushels, and
" screenings...174,924 " =113 "

Saving..... 21,384 " for the month, or 690 lbs. of fuel per day=11 per cent.

But this is not the whole saving, for all of the 4,788 bushels of coke formerly used are left for coke sales. The screenings previously had been a great nuisance about the works, there being no *use* for them, they were no better than cinders or any other refuse and quite an annual expense was necessary to secure the removal thereof. Here was item No. 3 in the saving. Aside from economy in fuel there are other advantages, one of which is, the clinker is much more easily removed, and the heat is kept more uniform. The introduction of this fuel presented some obstacles which a little firmness and common sense combined seemed to remove.

A change of grate bars was of course necessary, it being found that thin bars about ¼ of an inch apart answered the best. One of the first obstacles was that the fireman knew that "that stuff wouldn't burn." Now he knows that it will. Perhaps a suggestion made at the time to the effect that if he could not burn it another man would be found who could may have facilitated his acquiring this information.

Having arranged the bars properly a thin layer was spread on after the fire was started. The front of the ash pan was closed with doors fitting closely, and a blast from a small blower was let into the ash pit. In a short time the breeze was burning nicely, but of course being a thin layer would soon be consumed. Another thin layer was spread evenly over the fire, and so on. It was found necessary to feed the fire about once in 20 to 30 minutes, but the quantity of fuel added each time is so small that the heat of the boiler is not perceptably lowered. This also prevents the fireman from putting on twice as much fuel as is necessary, and then leaving the door open so as to save himself the trouble of firing up.

The next obstacle was the filling of the tubes with the fine dust and small particles of breeze. Again a remedy was found. Attaching a flexable tube to a stop cock in the steam pipe this was connected with an iron pipe long enough to reach over the fire and into the tubes a few inches. Steam being turned on rushed through and in a few seconds the boiler tubes were as clean and bright as possible, so by shifting the pipe into each of the tubes in succession they were all

cleaned in a very few moments, a pit being arranged at the other end of the boiler for the dust to fall into. This operation did not bring down the steam in the boiler, but on the contrary actually raised it. This has to be done daily. The fire has to be cleaned regularly, but when a clinker forms it is in a thin sheet that is easily removed, so that it is really easier to keep the fire clean than with coke.

The results given above are taken from a boiler running from 65 to 70 pounds of steam. But where a small head of steam is required we find no blower necessary, the same natural draft that was used before for coke being ample in such cases where 25 or 30 pounds are required.

Experiments have been made with other than tubular boilers which worked in an equally satisfactory manner, and the result has been to create a demand for screenings for use as fuel, so that what was formerly a nuisance and expense is now an article in demand. Here again is an evidence that gas makers never utilized *all* their waste products. In giving the readers of your valuable journal the above facts it is not with any desire to claim any particular credit in this matter, but simply to contribute something that may be of benefit to the general economy of gas making. The only point where any objection could be made is on the part of the fireman, who has to tend to his fire and renew it every 20 or 30 minutes instead of "filling her full and letting her go," while he reads the newspaper or takes his nap. But to my mind it is no *great* disadvantage either to the fireman or the works if he has to attend to his business regularly.

Production of the Pennsylvania Oil Regions.

By Henry E. Wrigley.

[*From the Second Geological Survey of Pennsylvania, J.*]

During the fifteen years which have passed since the striking of the Drake well, the Pennsylvania Oil Region has produced up to January 1st, 1875, sixty-seven millions seven hundred thousand barrels of oil, which brought at the wells the sum of two hundred and thirty-five millions five hundred thousand dollars. Of this amount, 3,200,000 barrels are stored to-day in the tanks of the Oil Region.

The following table of production, price and export, will show more fully the progress of the business from year to year :

YEAR.	Production in bbls.	Average price for the year.	Amount.	Bbls. exported crude equivalent.	Crude, value of export at the wells.
1859	3,200	31 cts. per gallon.	$41,664 00	.....	.....
1860	650,000	16 cts. "	4,368,000 00	.....	.....
1861	2,113,600	$ 2·73 " bbl.	5,770,128 00	27,812	$75,926 76
1862	3,056,606	1.68 " "	5,135,098 08	272,192	457,282 56
1863	2,611,359	3·99 " "	10,419,322 41	706,268	2,818,009 32
1864	2,116,182	9·66 " "	20,442,318 12	796,824	7,697,319 84
1865	3,497,712	6·57 " "	22,979,967 84	745,138	4,895,556 66
1866	3,597,527	3·73 " "	13,418,775 71	1,685,761	6,287,888 53
1867	3,347,306	3·18 " "	10,644,433 08	1,676,300	5,330,634 00
1868	3,715,741	4·15 " "	15,420,325 15	2,429,498	10,082,416 70
1869	4,215,000	5·85 " "	24,657,750 00	2,568,713	15,026,971 05
1870	5,659,000	3·80 " "	21,504,200 00	3,530,068	13,414,258 70
1871	5,795,000	4·35 " "	25,208,250 00	3,890,326	16,922,918 10
1872	6,539,103	3·75 " "	24,521,636 25	4,276,660	16,037,475 00
1873	9,879,455	1·84 " "	18,178,197 20	4,981,441	9,165,851 44
1874	10,910,303	1·17 " "	12,765,054 51	4,903,970	5,737,644 98
	67,707,094	3·48	235,475,120 35	32,490,971	113,950,153 26

Total production, 67,707,094 barrels ; average price $3 48 ; total value of yield at wells, $235-, 475,120 35; total amount exported, 32,490,971 barrels; total value at wells of crude oil exported, $113,950,153 26.

The total number of wells drilled in the region from the start to January 1, 1869, on or near actual producing territory, was 5,560 ; the amount of oil produced up to January 1, 1869, was something less than 25,700,000 barrels, giving the entire average production of each well at nearly 4,600 barrels. The amount realized for oil up to January 1, 1869, gave an average of $4 06 per barrel, or $18,700 for each well.

From that time forward until the present, the outline of the underlying strata being understood and defined, and the failures proportionately less, the figures are as follows :

In 1869,	there were drilled	....	991 wells.
In 1870,	"	"	....1,007 "
In 1871,	"	"	.... 946 "
In 1872,	"	"	....1,032 "
In 1873,	"	"	.... 530 "
In 1874,	"	"	.... 433 "
*Total from '69 to '74, inclusive.			4,939 "

At round numbers, five thousand wells have been drilled since January 1, 1869, producing forty-two millions of barrels, at an average price of $2 91, giving a production to each well of 8,400 barrels, and a gross earning of $24,500. Of the 10,500 wells that have been drilled on or near actual producing territory, 3,250 are pumping to-day, with an average production of less than ten barrels each.

It will be seen that during the last six years we have nearly doubled the average entire production of a well, with but a slight increase in gross revenue. It will also be observed that three hundred wells drilled before January 1, 1871, are pumping to-day.

Making a fair allowance for wells recently started, we shall have the average life of a well at a little over two and one-half years.

If the cost of drilling the 5,560 wells up to January 1, 1869, was $4,000 each, the cost of drilling was $22,240,000. If the cost of drilling the 5,000 wells since January 1, 1869, was $6,000 each, the cost of drilling was $30,000,000. Assuming 8,000 wells to have been a success, and to have averaged a life of two years each, at a cost of $10 per day for all expenses and shut-downs, the cost of pumping would be $58,400,000.

The cost of 39½ square miles of actual producing territory, 25,280 acres, at $500 per acre, $12,640,000. The petroleum account, therefore, of the actual producing territory only, taking no account of failures or outside operations, is as follows :

Total amount received at the wells, Jan. 1, '75.		$235,475,120
Cost of drilling.....	$52,240,000	
Cost of pumping.....	58,400,000	
Cost of territory.....	12,640,000	
		$123,280,000
Profit		112,195,120
		$235,475,120—$235,475,120

The net profit, therefore, of producing 67,700,000 barrels of oil was $112,200,000, or $1 67 per barrel. If it were possible to include in any statement of this kind the amount expended in "wild-catting" and speculation, it is doubtful if the net profit would amount to $1 per barrel.

The present watershed of the country through which passes the eastern range of oil production from New York to Tennessee, is that defined by the Ohio and Allegheny rivers, and the shores of Lake Erie.

Furthermore, it is convenient for geographical reference, to note that all the oil found in the eastern United States, is contained in a belt or range parallel with, and considerably west of, the Allegheny Mountains.

The four separate oil regions differ from each other so materially in almost every particular, that an accurate conception of the relative value of our own section would not be obtained by the general observer, without noting the special characteristics of the other three.

THE CANADA OIL REGIONS.

The Canada Oil Regions are situated in the western part of the Dominion, in the counties of Lambton, Bothwell and Kent, Province of Ontario. They extend from near Lake Erie to Lake Huron, and from the St. Clair river eastward about seventy miles.

The oil of Canada is found in a flint-bearing limestone, varying from close to open in its construction. and largely composed of marine shells, and other fosails peculiar to that geological horizon. the "Corniferous Limestone."

The gravity of the oil is from 33° to 48° Beaume.

The entire production of the Canada Oil Region, at present, does not exceed 2,500 barrels per day.

THE OIL REGIONS OF OHIO AND WEST VIRGINIA.

These oil regions are confined to two plainly marked belts of geological disturburance, one extending from Newport, Ohio, north through Washington and Morgan counties, and southward, in West Virginia, about forty miles through Ritchie, Wood and Wirt counties, and embracing the producing localities of Horse-neck, Sand-Hill, Volcano (the principal point), White Oak and Burning Springs, and a smaller belt a few miles to the west of it.

Oil is found in crevices at a certain fluid level, without the slightest regard to the character of the rock in which the crevice may exist. Where a natural crevice has not been reached by the drill, the use of the torpedo seldom fails to open connection with one.

The oil ranges between 28° and 40° Beaume, and wells of all gravities of oil are found indiscriminately side by side.

The total production of the entire region, at present, does not exceed five hundred barrels per day.

KENTUCKY AND TENNESSEE.

Had it been ordered that the Ohio river should flow eastward, instead of West and South, it is probable that Kentucky and Tennessee would, to-day, share with Pennsylvania in the supply of petroleum to commerce.

All that we know at present, reliably about this section, is, that it has produced, from surface wells, enormous quantities of oil.

Gas Machines.

The National Board of Fire Underwriters have recently adopted a report, specifying how gas machines are to be set up, so that buildings may be safely lighted by them.

The report is very full and completely covers the whole ground, explains the nature of gasoline and the peculiar characteristics of gas made from it; speaks of the different kinds of machines in use, provides that in all cases no gasoline shall be permitted within an insured building, but shall be kept *outside*, in a vault under ground or buried in the earth, that so far as practicable, all pipes shall drip toward the main, shall be tested and made tight, that there shall be cocks in the air and gas pipes, and that the whole apparatus shall be arranged substantially as shown in the accompanying cut. Great emphasis is laid upon the necessity of using the best and most durable metals in the construction of machines and to the importance of having the work of setting done by experienced and competent mechanics. The report provides that when machines are set in accordance with it, buildings are lighted with no more appreciable risk than if coal gas was used, and that they may be insured at same rates.

We are glad this question of risk has been finally settled. It has long been our opinion that gasolene gas machines, when well constructed and properly set up, afforded a *safe* and desirable means of lighting *isolated* buildings. Some years ago we carefully examined the "*Springfield*" Machine, and were favorably impressed with its correct principles of construction—the excellence of the material used in its manufacture (it is made wholly of *copper*), its simplicity, and many other good qualities. We have watched with a good deal of interest the improvements that have from time to time been made upon it, and which have increased its efficiency and power, besides, at the same time, cheapening its cost. This machine, as now manufactured, is about perfect. We can conceive of no simpler, safer, or more effective apparatus for lighting *isolated* buildings. As shown in the accompanying cut, it consists of two instruments, an air pump, operated by a weight, and a gas generator (a copper cylinder, containing evaporating pans or chambers).

Gas is manufactured by bringing a current of air in contact with gasolene. The gasolene is kept in the gas generator, in a vault underground, (or the generator may be buried in the earth, in which case the expense of an arched vault is saved). The air pump is usually placed in the cellar of the building lighted. This automatic air pump is supplied with air drawn from without the building, through an induction pipe, and is forced through the air pipe and gas generator; in its passage through the generator it becomes carburetted, thus forming an illuminating gas that is returned through the gas pipe to the burners within the building.

The process is *automatic*—gas is made only as fast as consumed—when the burners are shut off, the pump stops, and the manufacture of gas ceases; but immediately commences when they are opened again.

The gas generater is recharged whenever exhausted, usually once in from three to six months, varying according to the rapidity of the consumption of gas.

There is a *retaining power spring* within the pump, which propels it while the weight is being wound, operating upon the same principle as the retaining power spring of a watch.

This machine possesses many valuable features which are patented; among others, and by far the most important is that covering the improved method of setting the apparatus, by which the gas generator is placed in a vault underground (or buried in the earth), and removed from the building lighted a safe distance, and the air pump is located in the cellar of the house, conveniently accessible. A machine is set in this manner at less expense, is safer, requires less care and attention, and is much more reliable in winter.

So important are these advantages, that many other manufacturers have remodeled their machines and adopted this plan of building and setting, thus infringing these patents.

Suits have been brought against such infringers, by the Gilbert & Barker Manufacturing Company, proprietors of the Springfield Gas Machine, and their patents have been sustained by Mr. Justice Louis B. Woodruff, U. S. Circuit Judge.

The public are cautioned against buying infringing machines.

The "Springfield" Machine is no new or untried thing, but has been in use, in almost every state in the Union, for the past eight years—over 1,000 are now in operation; gas made by them is a rich carbon; gives a peculiarly white, clear flame; and is produced at a cost of about *one dollar* per thousand feet. Ordinary gas pipes and fixtures, and either the batswing or Argand burner, are used.

The Gilbert & Barker Manufacturing Company solicit from Gas Engineers, and the trade, a critical examination of their machine, and comparison with any other in the market.

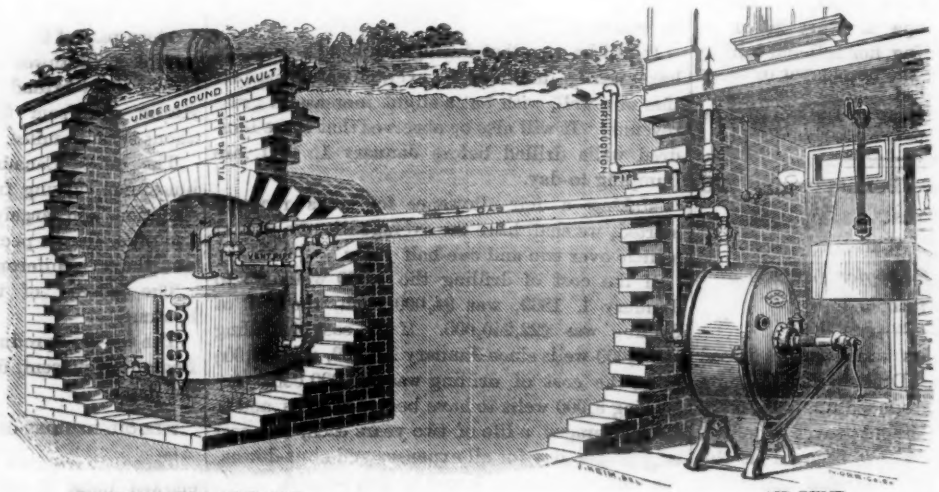
Its claims for your consideration are based upon its correct principles of construction, its safety, reliability in operation, and the mechanical excellence of its manufacture. It stands upon its merit and record.

It received a Medal of special award from the American Institute, in 1872; also, in 1874, a Diploma for "continued excellence."

A silver medal from the Maryland Institute, Baltimore, in 1873; the same at the Cincinnati Industrial Exhibition, in 1874; also, from the Central New York Agricultural, Horticultural and Mechanical Association, held at Utica.

The Highest Award at the New York State Fair, at Rochester; also, at Albany, and at other like fairs and competing exhibitions.

Circulars giving full description, with cuts, price list, references to parties using, also full instructions for setting up the apparatus, copies of the Insurance Report to which we have referred, and of Judge Woodruff's decision in the patent litigation, will be mailed upon request. Reliable, competent agents are wanted to introduce the machine, and to such they offer liberal inducements.



GAS GENERATOR IN VAULT.
Distant from House Fifty Feet or More.

AIR PUMP
In Cellar of House.

SPRINGFIELD GAS MACHINE.

Springfield, Mass., and 238 Canal Street, New York.

They, in common with most New England Manufacturers, are making preparations for a creditable exhibition at the *Centennial* in Machinery Hall.

All applications and correspondence from parties outside of New England, should be addressed to the Gilbert & Barker Manufacturing Company, 238 Canal Street, New York.

Terrestrial Magnetism.—If the earth is really a magnet, the magnetism of soft iron ought to be decomposed by it, in the same manner as is done by a bar magnet, and such is the fact. If a bar of soft iron is held in the direction which the magnetic needle assumes when freely suspended, its lower end immediately becomes a north pole, and its upper end a south pole, as is shown by bringing a small magnetic needle near each end of the bar. On inverting the bar, it will be found that its poles have immediately changed, the lower end being a north pole, and the upper one a south pole. If the bar is held horizontally, pointing east and west, no such effect takes place. When a bar of iron is rendered magnetic by the influence of terrestrial magnetism, a stroke of a hammer will sometimes fix the magnetism, and the poles will not be reversed when the bar is inverted. But if several blows with the hammer be struck when in the inverted position, its magnetism may be destroyed or its poles be reversed.

Purification of Gas in Closed Vessels.

From the London Journal of Gas-Lighting.

[We gave in the issue of January 3d some suggestions by Mr. George Anderson, of London, on this subject, and we now give a further discussion of the same. We trust that some of our readers who are practically familiar with this subject, will avail themselves of our columns to criticise or reply to the same, if they see anything wherein they deem Mr. Anderson is in error. This is too important a matter to be passed over lightly, and we hope that it will be carefully studied and fully discussed.—Ed.]

Sir.—There are some things reason tells us so strongly can be done, that, although we have not done them, we consider it quite unnecessary to go to any expense in making an experiment.

Such cases as those in which we already possess a considerable degree of analogy of things so similar that, unless some point has been overlooked—forgotten, indeed—the result that we expect we say must take place.

For instance—Will a duck swim? Will a well-balanced magnetized needle point northwards? Will an acid and an alkali combine?

Answers to such questions we reason out in the laboratory of the soul. It is where we doubt—are sceptical—that we refer to the grosser laboratory of the workshop.

Now, in the purification of gas we require to remove both acid and alkali, or, at least, we should. And when I say we should, I do not refer to duties fixed upon us by an imperfect and erring Legislature, but, in my opinion, to an infinitely higher standard—to our duty as intelligent and sentient beings, playing our part well and truthfully in the grand arena of Nature, while we utilize to the uses of man the wonderful and hitherto inexhaustible resources of that great whole of which, personally, we are such an insignificant part. Knowing, as we do, what an ever-extending outlet there is in this grand nation of ours for any amount of an article that is both good and cheap, the measure of our duty should be what we can do—how much we can interrogate Nature and get out of her, not how little we can do to save our own withers. We should lead a long way in advance, not follow behind, the cumbrous machine of legislation.

The consumption of gas doubles itself in most places every ten years, in some places much faster, whilst the population only doubles itself in something like thirty years; notwithstanding this, coal gas is not the most salubrious light you can have. It does bleach out the colors from fine fabrics; it does sometimes tarnish gildings; it does give headaches; and there are many sensitive organizations that can tell you more about it than all your chemists; and the dullest of us, in our noses and in our tongues, have tests that no chemical tests can compete with.

If gas, then, in its present state, can make such strides that, all in all, it eclipses all other modes of light, what would it do if we could extract all noxious substances which, in many places, it still contains, and which are not necessary, but rather destructive to its light-giving qualities? Why, we would extend its use much faster; we would increase the capital invested in its supply; and also increase the number of hands employed in its manufacture, thus forming an outlet for both capital and labor, in both of which the nation abounds.

While making these remarks, I am not to be supposed to join in that brawl which is periodically heard in Town Councils, and such like places, against gas. If the impurities which gas still contains cannot be removed without considerably increasing its cost, I would rather look to ventilation for getting rid of them; but if they can, then by all means let us make the attempt.

But I by no means think that any such attempt, persistently and intelligently conducted, will result in loss, but rather in gain, to gas companies. The abatement of the smoke nuisance, once so terrifying to manufacturers, ha resulted in a saving of coal in furnaces. So of the fumes from chemical works, whether arsenious, sulphuric or chlorine, are now utilized and profitable. So of gas liquor, which gas companies used to be indicted for polluting rivers with, is now one of the most valuable products—it is a waste product no longer. The same of tar, which I remember to be unsaleable at one-tenth of a penny per gallon, while now, with a much larger quantity in the market, it fetches threepence, or thirty times the value it did in the year 1854.

Of five impurities in crude gas we have already utilized three—viz., tar, ammonia, and the sulphur from sulphuretted hydrogen. Why should we not be able to utilize the remaining two, viz., carbonic acid and bisulphide of carbon.

Both of these substances are now manufactured for their own sakes at considerable cost, yet we have an enormous quantity of the former mixed up with other substances, while we are too ignorant to extract it profitably.

We are in the position that the proprietors of some lead mines were in a century ago. The ore was so poor that it took 21s. to extract 20s. worth of lead; yet the lead contained a per centage of the much dearer metal—silver; but they were too ignorant to extract it profitably. This was, however, at length accomplished, and mines which formerly were worked at a loss, could now be worked at a profit. So may it be with gas.

Nature has no waste products, she works them all up; and I believe if man understood her, he would be able to do so too. Also, that should we try and fail, we may come out sadder, but we are sure to come out wiser men.

In the remarks which I have to make on the purification of gas, it will be well first to review what has been already attempted, and more or less succeeded or failed, and, if we can, trace the cause of the failure.

The first thing that attracts notice is the manner in which the presence of carbonic acid has been ignored.

I can clearly see that several gentlemen have been, as it were, on the brink of success, and have failed through ignorance of the action of this one impurity.

Mr. Laming, 12 to 15 years ago, passed ammoniacal liquor through oxide of iron, and then through a scrubber, where, as Mr. Harris has told us, it would purify the gas for half an hour at a time, but could not be depended on, and was abandoned, and the reason given for its failure is, that the distributing apparatus was not equal to "bring the caustic ammonia sufficiently in contact with the gas."

The liquor thus treated is described as "pure caustic ammonia," while I expect it still contained the carbonic acid with which ammoniacal liquor is contaminated to an extent of three times the quantity of the sulphuretted hydrogen that had been removed.

It is quite evident that the purification here spoken of as having succeeded for half an hour, was only purification from SH_2, and that as soon as the liquor had reabsorbed a quantity equal to that which had been taken from it by passing through the oxide of iron, it would begin to give off, not only that SH_2, but all the SH_2 in the gas passing through, by the action of the CO_2 of the crude gas combining with the ammonia, and compelling it to yield up the SH_2, as is *now* well-understood. Again, in the proceedings of the Gas Managers Association for 1870, I find there stated in an article on scrubbers:

"Mr. (I omit the name) now believes that the highly-concentrated liquor * * * * would probably absorb a portion of the sulphur compounds which give so much trouble."

Now it is evident that this was a prevalent belief—at least in London—namely, that the stronger the ammoniacal liquor, the more efficacious in the removal of those sulphur compounds which were then giving so much trouble; but when, under the instructions of the referees, the gas at those scrubbers was tested by the respective engineers, one gentleman actually found more sulphur at the outlet than at the inlet, and tore up his records, believing he had in some way bungled it. And, in the discussion that followed on the above-mentioned paper, I find one gentleman admitting that he had found it to be the case—more sulphur after than before the scrubber; and he believes that this result arises from his having used coke to fill the scrubber, meaning that cold gas, passing through cold coke, would extract sulphur from it. No one says a word about the effect that CO_2 might have in liberating sulphur, any more than if it had not been present, or, if present, unable to act so as to account for the increase of sulphur.

Again, I find in a patent of one of our metropolitan gas engineers, that while he specifies the virtues of sulphides of the alkalies in arresting the sulphur compounds, and describes the purification of gas from the condenser to the gasholder, and enumerates the impurities contained in crude coal gas, he omits to mention CO_2 as one of them. The word carbonic acid is not mentioned throughout the entire specification but once, and then under a mistaken notion that passing ammoniacal liquor through oxide of iron would rid it of carbonic acid, which is a mistake; indeed, the necessity for removing carbonic acid from gas is not mentioned, while directions are given for the purpose of producing sulphides, which, in my opinion, would never produce sulphides unless the carbonic acid were previously removed, of which there is not the remotest hint.

Again, those of us who are conversant with the purification of gas in London only a few years ago, know that in some works no attempt was made to remove CO_2; its presence was known, but it was not known to have any effects beyond slightly reducing the illuminating power, to sustain which extra cannel coal was employed.

This state of mind was not universal, for I know that many of us used different means to deprive gas of CO_2, and with varying success. But we did so more with a view to remove a noxious ingredient, than with any well-defined principle in our minds, that its presence prevented us from being able to remove *other* impurities which some of us were under penalties to remove.

We have indirectly to thank the authorities of the Chartered Gas Company for the light which enables us to now purify gas on definite and intelligible principles; and we have directly to thank Mr. R. H. Patterson for having discovered that, until you remove CO_2 from gas, it is useless to expect to deal with the sulphur compounds.

When Mr. Patterson, in his capacity of gas referee, found that at the Chartered works these impurities were in excess, and the excess entirely beyond the control of the company's engineers and chemists, he was led to the conclusion that all the evil was due to CO_2 being allowed to penetrate to all the purifiers of the series; and I believe that, since the company erected additional purifiers, which are used first, and beyond which CO_2 is not allowed to go, the sulphur compounds have diminished to less than one-fourth of what they sometimes formerly were, while the quantity that still remains is steadily within a few grains, one time with another—proving that the work is done under a law, and not by chance or accident.

So far, then, it appears that, by whatever kind of vessels, or whatever purifying materials we may employ, we must lay our account to require four different purifiers, as many of each sort as may from the size of the works be necessary—namely, one set to remove carbonic acid, a second set to remove ammonia, a third set to remove bisulphide of carbon, and a fourth set to remove sulphuretted hydrogen.

It does not necessarily follow that we must quadruple our present system of purification, but that we must divide up and work our present purifiers differently, and no doubt, in many cases, add to the number we now have.

The mode of working the purifiers, as well as the material to be employed, I must leave to another letter.

If you take ammoniacal liquor from the hydraulic main, which may be about 3 to 4 ounce strengh, and

pass crude gas through it sufficiently long, you may raise it to 20 or 30 ounce strength.

Hydraulic-main liquor of 2½ ounce strength I have found to contain 400 cubic inches of CO_2 and SH_2; and when worked up to only 14½ ounce strength, it has contained 5000 inches of these impurities.

Ammoniacal liquor is, therefore, a purifier of crude gas. This we all admit; but the quantity of CO_2 in the coal being greater than either the ammonia or the SH_2, the liquor gets carburated, and becomes inert before the gas is sufficiently purified; hence the liquor (even with the addition of a considerable quantity of pure water, which is also a purifier of crude gas) is of itself insufficient; but if we can cheaply remove both CO_2 and SH_2 from the now fouled liquor, we will give the liquor new life, and power to resume and complete its unfinished work. If you pass crude gas from the outlet of the condenser, through caustic ammonia, you can rid it of every trace of SH_2.

That CO_2 can also be removed by the same agent, is, no doubt, equally true, for this is one of the questions I take for granted, "Will an acid and an alkali combine?"

If the foregoing reasoning, then, be true, we may by a proper use of the ammonia contained in the coal, remove all impurities from the gas.

This brings me to what is the proper way to employ the ammonia, for a very trifling error here will destroy the whole process.

First, then, the condensation having been performed, pass the crude gas into a vessel charged with the weak liquor of the previous processes, and I do not care how weak it is—the weaker the better.

The result produced in this vessel is to strengthen the liquor up to 14 or 16 ounces, when it may be either sold or treated for decarbonating, as shall be described, and in so doing, we have removed from the gas a very considerable quantity of carbonic acid, sulphuretted hydrogen, and ammonia.

Next, pass the partly purified gas into another vessel charged with pure ammonia—*i. e.*, gas liquor from which carbonic acid and sulphuretted hydrogen have been removed, and this vessel (or vessels) *must* be capable of extracting the whole of the carbonic acid, and the gas issuing forth must be tested for this impurity.

The gas, now freed from carbonic acid, is next to be passed through a vessel charged with pure ammonia, which it will sulphuret or convert into what the chemists call sulphide of ammonium, in which state it is found capable of extracting those fixed compounds of sulphur which are not distinguishable by the ordinary test-papers.

From this last vessel the gas must pass into another vessel, also charged with pure ammonia, but this time only to extract the remaining sulphuretted hydrogen; and, lastly, it must be passed into a vessel charged with pure water, to remove the whole of the ammonia, when the gas will be purified.

In practice, it will, no doubt, be found convenient to run the contents of a later vessel into an earlier one.

For instance, vessels containing merely weak ammonia as the last, or merely sulphuretted liquor as the one next to it, may be run into vessels Nos. one or two; but the extent to which this can be done will depend upon how far they can bear it without injudiciously interfering with the chemical conditions to be maintained, as before described, and no doubt different qualities of coal will differently affect this.

I make these last observations because I think I have seen it somewhere stated that the sulphur compounds known as bisulphide of carbon, once removed, become fixed in the material with which they have combined. If this is so, the contents of all the vessels might change, as used to be done in wet lime purification, but I am inclined to think that this cannot be so, and I would hesitate to run a vessel charged with bisulphide of carbon into one in which I desired to fix the more active acid, CO_2, for I would be afraid that it might liberate sulphur in every form, and not only such forms as could be afterwards removed.

Before leaving this part of the subject, I desire to state that I have not made experiments that will bear me out in all the statements I have made. In some instances I have not, but where I have not I have accepted the statements of chemists—as to the combinations that will be formed, when these have agreed with, or did not contradict, what I already knew on the subject.

The next question that arises is, how are we to purify our liquor for use, over, and it may be several times, over again?

The chemistry of how it can be done is very simple; but how it is best to be done is not so simple—how it is to be done cheaply and readily in large quantity, and not increase the cost of the gas.

Mr. Livesey told us at Leeds that he was using liquor purified by a process invented by Mr. Hills, of Deptford, and he gave a very good account of the results he obtained by the use of it in his scrubbers. This was by the application of heat. If the process is effectual, we can get that heat either from the hot furnace gases before they enter the chimney, or from breeze, which is now, in many places, an unsaleable drug.

Should this process not produce the liquor sufficiently pure, perhaps it is within the domain of known chemistry to teach us some practical method of separating the carbonic acid and sulphuretted hydrogen, while, at the same time, giving us the ammonia to act on the gas.

It often happens in a country that there is plenty of knowledge, and also plenty of wants; but, for lack of the knowledge and the wants being brought together, things remain as they are. I now bring a want to the minds of those chemists who apply themselves to gas affairs; it is for them to supply a remedy.

I have now—in an imperfect manner, I know—given my views as to how gas may be purified in closed vessels. The time at my command has been quite insufficient to enable me to deal so fully with the matter as I feel it deserves.

If gas can be purified as I have described, and the noxious ingredients, all save carbonic acid, fixed in substances in which they create no nuisance to our neighbors, and from which they can be separated, and made both useful and profitable, it is worth a trial.

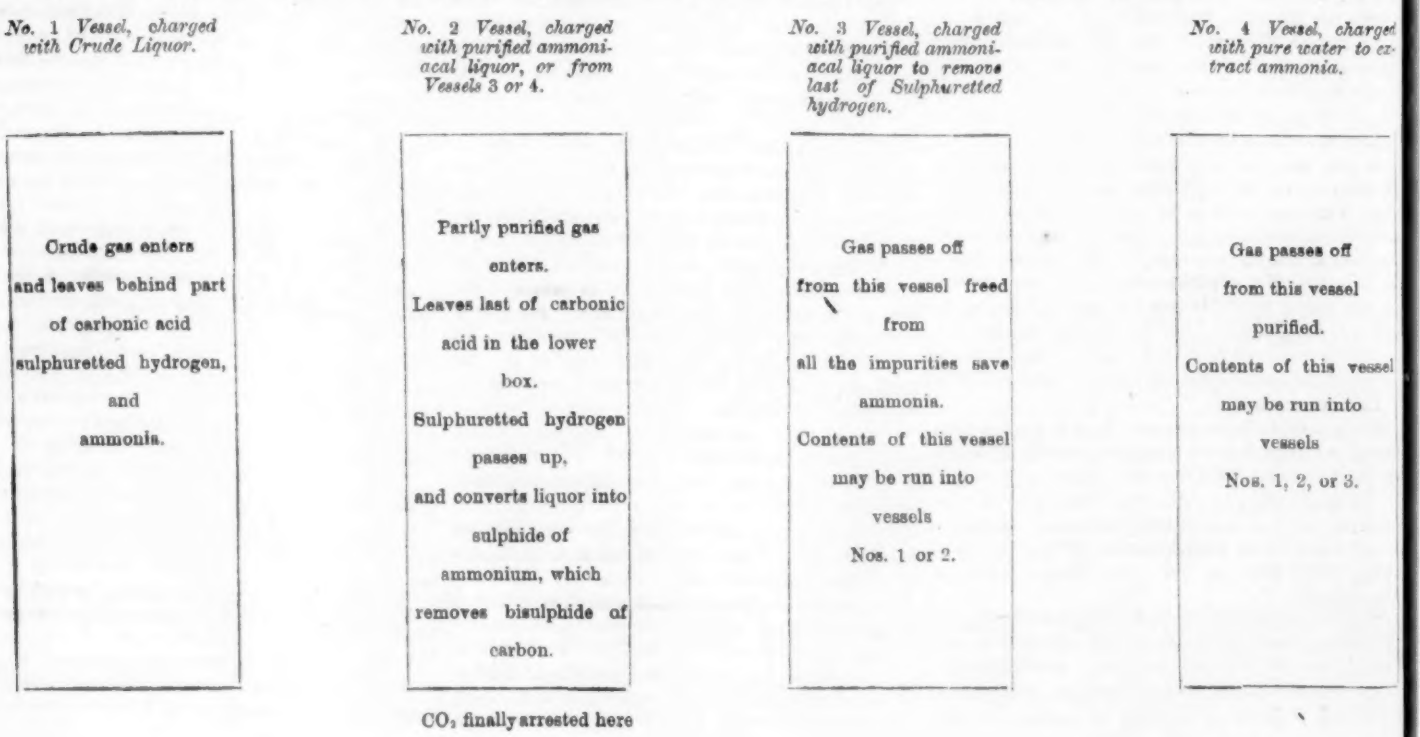
If gas can be purified by a liquid process, and the different altitudes of the vessels so arranged, that much may be done by gravitation, and the remainder by pumps, worked by our steam-engines, I feel that there is every probability that the process will be cheapened; and I believe also that such vessels may be provided at much less expense, and occupy much less space, than those now in use for lime and oxide.

On the other hand, the process I have described may be useful to supplement the present system of purification: for instance, the present washers or scrubbers may be retained to act as vessels Nos. 1 and 4, and the present purifiers, whether for lime or oxide, may act in lieu of vessel No. 3, leaving only No. 2 vessel to extract the bisulphide of carbon, as sulphide of ammonium will do this with less smell than the sulphide of calcium can.

I thank you for the space you have permitted me to occupy, and trust that men of experience and leisure may be induced to consider the matter, and give us the benefit of their investigations.

GEO. ANDERSON.

London, Dec. 16, 1875.



Gas Fuel in Metallurgical Operations.

The *Iron Age* contains a very interesting article upon the use of gas fuel in metallurgical operations from which we make the following extracts:

"The use of combustible gases in the manufacture of iron and steel, is extending so rapidly, and shows so great an economy of fuel, that it deserves the close attention of all engaged in the trade, especially as the coal business of the country is rapidly assuming a shape which threatens a gradual and permanent advance in the price of fuel.

"Before entering upon an examination of any special apparatus for the combustion of generator gases, it is well to consider their production and composition. Many kinds of compact fuel, from their conditions of aggregation, large percentage of ash, etc., do not allow of direct use, while their gases can be judiciously and effectively consumed. Moreover, the best fuels consumed through their gases yield far more nearly their theoretical heating power than by any other method of combustion. In the absence of mineral coal, also, the fuel available for metallurgical purposes are the gases of wood, peat, etc. The production of these gases is effected with great simplicity in generators or upright furnaces, partially filled with the fuel to be volatilized. Air is admitted to the lower part of the generator, by either blast or draught, producing carbonic acid and oxide in variable proportions as to the fuel, atmospheric pressure, etc.

"The gases thus produced, in their ascent through the column above, the height of which varies according to character of fuel, are transformed into carbonic oxide, which it only remains to conduct to the place of combustion and burn with the admixture of either cold or heated air. This carbonic oxide is made impure, however, by the nitrogen of the air of combustion, and contains more or less carbureted hydrogen, owing to a dry distillation in the upper layers of fuel. The composition of generator gases is stated by Scheerer to be as follows, with their heating power:

	Wood. I.	Wood. II.	Peat.	Charcoal.	Coke.
Nitrogen					
Carbonic Oxide	53·2	55·5	63·1	64·9	64·8
Carbonic Acid	34·5	21·2	22·4	34·1	33·8
Hydrogen	11·6	22·0	14·0	0·8	1·3
Total	100·0	100·0	100·0	100·0	100·0
Absolute heating power	0·095	0·084	0·063	0·079	0·078
Specific heating power	0·000124	0·000109	0·000082	0·000103	0·000098
Pyrometric heating power	1326°C.	1165°C.	1·070°C.	1260°C.	1240°C.

Siemens reports the composition of a generator gas made at the glass works, St. Gobain, France, by burning a mixture of ¾ caking coal and ¼ non-caking coal by analysis as follows:

Carbonic oxide	23·7
Hydrogen	8.0
Carburetted hydrogen	2·2
Carbonic acid	4·1
Nitrogen	61·5
Oxygen	0·4
	99·9

The trace of oxygen is claimed to be due to carelessness in collecting the gas, or leakage into the flue, and allowing for this, the corrected analysis will stand as follows:

Carbonic oxide	24·2	34·6
Hydrogen	8·2	
Carburetted hydrogen	2·2	
Carbonic acid	4·2	65·4
Nitrogen	61·2	

Only the first three of these costituents—say, 35 per cent. of the whole—are of any use as fuel, the nitrogen and carbonic acid only diluting the gas. It is the large proportion of inert gases that renders it difficult to maintain a high heat by gas of this kind burnt in the ordinary way. Hence the necessity of some form of regenerative furnace where the presence of nitrogen is not objectionable, as the heat it carries off is given up again to the air and gas coming in.

The materials from which generator gases can be produced are so numerous and abundant, in practice, that this form of heat especially commends itself to all sections of the country. Coal is, of course, the principal fuel to be used, but may be utilized in various forms now regarded as waste. Small coke is used in England, wood is employed in France, Bohemia and Spain, sawdust in Sweden, lignite in various parts of Germany, and peat in Italy and elsewhere. Probably peat may be regarded as one of the choicest fuels for the production of generator gases, which is of importance as affecting the value of the numerous deposits of the United States, especially since, by late experiments, it has been found that wet peat, as taken from the bog, can be successfully used under certain conditions for the production and maintenance of the highest heats.

The uses of the regenerative furnace of Siemens, are extended to various other industries beside iron and steel furnaces for simple heating purposes. They are in use perhaps quite as largely by glass makers as iron makers, and are largely employed by the producers of crucible steel and in the manufacture of steel castings. Their introduction has been followed by a rapid increase in their use throughout the world, and although expensive in construction and repairs, they as yet surpass any other form of gas furnace for purposes requiring a high, steadily maintained and controllable heat.

In puddling, ten hundred weight of small coal are used to the ton of iron, while a further saving is made in the yield of iron, which is stated as within 1 or 2 per cent. of the pig iron charged, a result never obtained by the old process, except where the loss of iron is obviated at the expense of adding rich ores for fettling.

Practically, the advantages of using gas heats are, economy of fuel, increased yield of product, and economy in repairs, as the chief benefits to be gained, but to those are to be added complete control of the flame or heat, greater cleanliness, order in works, and an entire absence of smoke.

"From the fact, as stated by Siemens himself, that the gas producer may be at any distance from the furnaces they supply if only at a lower level, it may be easily seen that all the gas fuel for a large works may be produced, as indeed is generally the case, outside the works, and conducted to each furnace or fire as required. Further, by Siemen's authority, it would be perfectly practicable to erect gas producers in the mines themselves, and consume the slack and waste coal *in situ*, instead of leaving it in the workings, and to distribute the gas by culverts to the works of the neighborhood instead of carrying coal to the different works, and establishing special producers at each, as in rising to the mouth of the pit the gas would acquire sufficient pressure to send it through several miles of culvert. This suggestion leads to another more practical in connection with the supply of gas fuels to cities and villages by corporations, as illuminating gas is now supplied. The practicability of generating the gas on a large scale, and with sufficient pressure to transmit it for distances, being demonstrated, there can be no material obstacle to the supplying of it to workshops or dwellings of an entire city, provided the proper appliances for burning it are substituted for those now in use. The economy in fuel, and of space in storing it, in transportation and handling, etc., would abundantly repay any cost of change in apparatus. That this or some similar plan will be the future fuel supply is now probable, and the progress made in the adoption of gas heat indicates that we shall hear of it in the near future.

"Give that man a front flue," yelled Beelzebub, as a terrified personage with the image of a gas meter branded on his forehead slid through the coal hole into Hades. He was a Director in a Brooklyn gas company.—*Brooklyn Argus.*]

Water-Traps and Soil-Pipes.

Dr. Fergus, President of the Faculty of Physicians and surgeons, Glasgow, and a distinguished sanitary authority, has for a long time given his attention to the question of the corrosion of old soil-pipes by the action of sewer-gas, and has been led to express his opinion on several occasions that the water-closet is under all circumstances dangerous, and that the whole system on which its use is based is as improper as it is costly. He inclines to the use of dry earth, or to some chemical treatment of domestic wastes. He makes no recommendation as to details, but believes that, if a small percentage of the cost of the present water-carriage system were judiciously used for experiment, some better plan would be found.

His latest paper on this subject is communicated to the Sanitary Record of December 18.

In this he proves that the water-seal of an ordinary siphon-trap is scarcely to be regarded at all as a barrier to the passage of sewer-gas, and that it has the further disadvantage of retaining enough decomposing fæces to produce within the pipe itself a sufficient amount of sewer-gas to accomplish all the evil that is feared, except such as comes by the conveyance from the sewer itself of gases containing the germs of disease originating in other houses. He made a series of experiments with a bent tube, its bend being filled with water after the manner of the usual trap. In the sewer end of the tube he inserted a small vessel containing a solution of ammonia. In fifteen minutes the ammonia had passed through the water of the trap, and had bleached the colored litmus paper exposed at the house end. In another experiment he produced the rapid corrosion of a metal wire exposed at the house end. To prove that this transfusion takes place not only with ammonia, which is lighter than air, he made the same experiment with sulphurous acid, sulphuretted hydrogen, chlorine, and carbonic acid, all of which were transmitted so as to produce their chemical effect on the other side of the trap within from one to four hours.

He says, "We are therefore ourselves very strongly inclined to believe the last alternative, namely, that, however drains may be well trapped, sewer-gas will find its way from them into our houses; and any one who is acquainted with Graham's investigations as to the diffusion of gases will readily understand how this will happen."

The same experiments were made with a vented pipe; and although the action was retarded, it still took place. The venting was not such as is to be recommended, that is, there was no clear and direct flow of air through the pipe; but it is more effective than many devices now in use, and considered quite sufficient.

Concerning the decomposition taking place within the trap, it is his opinion that it is almost impossible, even with a copious flow of water, to cause undecomposed fæces to be discharged through the bend. With any ordinary flow there is only an eddying of the water in the trap, not a sufficient movement of the whole volume to carry floating matters under the bend. "No mere flow of water will carry out the fæces which simply kept whirling round in it."

Often, with the mistaken idea that by adding a few inches to the depth of water in the trap an effective resistance will be opposed to the pressure of sewer-gas, these are made quite deep. Dr. Fergus recommends that the dip or bend should be only sufficient to secure a sealing; for, the deeper it is made, the more complete will be the retention of decomposing matters at the house side of the trap.

In view of the large amount of water being discharged, he considers it practically impossible to use any disinfectant in sufficient proportion, and with sufficient regularity, to secure a chemical disinfection of the suspended organic matters.

"Recently, I was asked to inspect some houses where there had been a considerable prevalence of typhoid fever. I believe it had been imported in the district by milk, and spread by the influence of sewer gas. The houses were good, and by no means old.

"In the interior I found that generally the water from the bath and a fixed basin passed into the trap of the water-closet, causing the water in the pan to be agitated every time the bath was discharged.

"This I consider a very bad arrangement, as the hot water would have a tendency to promote decomposition in the trap.

"Outside I found a large, deep cesspool, about 3 by 2 feet, and from 2 to 3 feet deep.

"The entrance-pipe, bringing the rain-water and house-drainage, was a little above the level of the water in the cesspool, while the exit-pipe was several inches below the same level.

"Covering the whole at the surface of the ground was an impervious stone, fitting very tightly over the opening; in fact it was hermetically sealed.

"On removing the stone there was considerable smell, and on stirring the water a copious evolution of gas; at the same time there was a considerable deposit at the bottom of the cesspool, although it had been cleaned out only two months before.

"The surface of the water was covered with floating fæces, which was not diminished by the most copious flushing. I have already remarked that there was the characteristic smell of sewer-gas, when the cover was taken off; and that the contents of the cesspool were in an active state of decomposition, as evidenced by the copious escape of gas when the contents were stirred.

Now, in the every-day condition of this cesspool, with the cover impervious and sealed down, where did this gas escape to? Not into the open air; and not into the sewer, the opening into it being several inches below the surface of the water. It could only do so by the pipe bringing the house-drainage and rain-water into the cesspool. In a word, the decomposition of fæces in the trap of the water-closet being facilitated by the hot water from the bath, the cesspool, from its capaciousness and the depth of the exit-pipe, was as much a laboratory for the production of sewer-gas as if ingeniously contrived to be so. This gas was compelled by the close stone cover to pass either up the rain water pipe, or into the houses; it would more probably do the latter, from the higher temperature within them. I have repeatedly found the house pipes to the drain carelessly jointed and badly laid, giving free escape to foul gas, which may, however, have some distance to travel before it finds exit, and thus render it extremely difficult to discover whence the smell originates."

Reviewing the mortuary record of the Registrar General from 1838 till 1871, he shows, that while what he calls "excremental pollution diseases" averaged, during the first five years of the period, 298 deaths per million of the population from diarrhœal diseases, during the last five years the average amounted to 1161 per million. There was no cholera epidemic in any one of these five years. Deaths from diphtheria rose from two cases per million in 1851, to 487 cases per million in 1859.

From 1838 to 1842 the deaths from zymotics were 3,770; from other causes, 18,308. From 1867 to 1871, the deaths from zymotics were 4,282; and, from other causes, 18,059. There was a decrease of deaths from other causes, and an increase in those from zymotic diseases, showing an improvement in general vitality; while from the greater use of badly arranged closets, the local causes of deaths increased.

While referring to engineers the questions of details, he gives the following concerning the general subject of drainage:

"1. Streams should never be arched over, and used as sewers; because, as the bed is always irregular and uneven, the flow will be retarded, and refuse matter will lodge and decompose in the crevices. If it is ever advisable to follow the course of a stream, then a regularly built sewer should be constructed.

"2. Care should be taken that sewers are laid in firm earth that will not 'give.' In 'made,' or loose sandy soil, they should be laid in concrete, or Brook's patent might be used.

"3. If, also, sewers are to pass through walls, great care should be exercised to prevent pressure upon them from the subsidence of the said walls. This might be done by making an archway, and allowing the drain to pass under it free from all contact. When this is not attended to, the drains frequently get broken or cracked, and so allow the escape of noxious gases.

"4. The small drains should open obliquely into the larger, in the direction of the current of water running in the latter.

"5. Iron and glazed earthenware pipes should be used as much as possible for house, soil and drain-pipes—lead pipes being very subject to decay.

"6. There should be a disconnection between the house-drains and the sewers, to effect which a number of contrivances have been suggested. When complete severance cannot be effected, there should be free openings both on the house and sewer sides of the trap.

"7. A plan of all the drains of each town and district should be prepared, and be readily accessible to the public; and in the same plan the subsoil of the place should be indicated.

"8. A plan of all the house-drains, showing their connection with the sewers, should be given with the title deeds of every house.

"It is quite a mistake to conceal house-soil pipes by putting them, as is generally done, in some out-of-the-way corner, covered from view, defects in them existing and producing much mischief without being suspected. Even the drains in the basements of houses should be laid in a built tunnel, covered with flags, so that, from time to time, any of them might be lifted, and the drain inspected.

"9. The laying of drains, their jointings and levels' insertion of soil pipes, and, indeed, everything connected with drainage, should be subjected to a most stringent and intelligent supervision."—*The American Architect and Building News.*

The New Beirut Water Works.

JOHN C. HURD ESQ.

[Written for Van Nostrand's Magazine.]

The prospect that some great political change will soon occur in the lands bordering the Eastern Mediterranean, makes it likely that particular interest may soon be freshly awakened in respect to many localities which are ordinarily remembered only in their connection with ancient and mediæval history. The capacity of Palestine and Syria to become the peaceful scenes of modern commercial and industrial energy, as they have been for centuries the sacred battle fields for successive invaders, of various race, faith, and civilization, may then become matter for practical valuations.

Already, for some years past, one city in Syria, Beirut, has been experiencing a renewed growth and a remarkable development in material progress. When, in 1851, under Mohommed Ali, Beirut, was made the quarantine station for Syria, and, indeed, its capital city, the population was about five thousand, when Mr. Thomson, in 1860, wrote his well known work "The Land and the Book," he thought it had risen to about forty thousand; and it is now estimated to be nearly one hundred thousand, of whom probably not more than one-fourth are Moslems. Very little is known of the earlier history of the place, and the city is not named in any Biblical narrative. It has, however, been an important place at various distinct periods: probably, even under the Phenecians, and certainly under the Greek empire of Alexander's successors, and under the Romans. It was deemed the most beautiful and salubrious locality at the head of the Levant. It enjoyed the privileges of a Roman colony in the time of Augustus. When Herod Agrippa, otherwise known as Agrippa the Great, held Syria and Judea with almost royal authority, under the Emperor Claudius in A. D. 41, he adorned the city with numerous public buildings in the grandly luxurious style characterizing the Imperial administration. This magnificence was almost obliterated by the earthquakes which, in the reign of Justinian, desolated many cities in the Eastern portions of the Empire. Some of the granite columns may still be seen beneath the waters of the harbor, and others incorporated into the modern mole or breakwater.

We may assume that Roman architects would nowhere omit provision for baths and fountains. There are still existing within the city several remarkable wells pierced into the rock; one, it is said, being one hundred and fifty feet in depth. The name of the city, indeed, is thought to have been derived from the word *beer*, signifying a well of water, in the Semitic languages. A canal was cut by Djerra Pacha to bring water from the small stream nearest the city called Nahr Beirut, River of Beirut. But the care of the ancient rulers for a copious supply of water is attested by the remains of a great canal aqueduct, now dilapidated as to the part nearest the town, by its having within a recent period been demolished to afford ordinary building material. Mr. Thomson thought that, before this took place, this aqueduct might, at a moderate expense, have been made to serve its original purpose. Its length was twenty miles, and its starting point in the Lebanon was two thousand feet above sea level. Where it crosses the "River of Beirut," by a conduit twenty feet wide, built of cut stone on three tiers of arches, still standing, the canal is one hundred and sixty feet above the bed of the stream. At this elevation it meets abrupt cliffs through which it passes by a tunnel cutting, to proceed on arches again, across the plains of Beirut. Remains of an aqueduct, probably still more ancient, cut through the rock under the existing city have also been discovered.

Considering the desolation which the country has continuously experienced during the last thirteen hundred years, it is a most interesting fact that Beirut to-day, is again supplied with water from the interior, and that this is done according to the modern system of hydraulics. To the American visitor who notices for the first time, in the pavement, the iron plates with the Roman capital letters, B. W. W., it seems strange that these initials should answer as well for "Beirut Water Works," as for those of Boston. The natural source for this modern supply is found in the *Nahr el Kelb* or the *Dog River*, which with the ancients bore a name of similar signification, *The Lycus*, often mentioned in the local history. It is but a very short distance from the place where it empties itself into the Mediterranean to a narrow pass, between the rather inconsiderable stream of water and beetling cliffs which for thousands of years has been known as a highway of great commercial and military importance. The limestone walls still display the sculptures here carved on them by successive nations in their day of strength and pride. Egyptian, Assyrian, Persian, Greek, Roman, Moslem and Crusader, have each in turn left here their memorial tablet. At various heights in the rocky flanks of the gorge are vast caverns, more or less accessible, ascending or descending in a labyrinth of chambers, some hung with huge stalactites, some traversed by streams descending in water falls to natural reservoirs ultimately communicating with the river. Others are accessible by boat from the stream at their entrances, and out of these issues the principal feeder of the river; the ultimate source of all being Mount Sunnin, the tops of which are often seen from the city covered with snow. Among the curiosities of the neighborhood is a natural bridge over the stream which is now used as part of a traveled road, with a breadth of one hundred feet, the arch being at a height of two hundred feet and a span of one hundred and fifty. This undoubtedly is a relic of some more ancient tunneling wrought by primæval streamlets.

The water for the city is taken at a height of seventy-four feet above the sea by a conduit partly built up in masonry and in part tunneled through rock, which carries it to the pumping station, a distance of nearly three miles. Here the water is passed through filtering tanks, and then by turbine wheels worked under a fall of sixty feet of water, is subjected to

force sufficient to carry it to the city, a distance of about eight miles. The iron pipe, through which it is sent has a diameter, at the pumps, of twenty-four inches, which is reduced, gradually to eighteen when near the reservoirs over the town. These, two in number, are respectively at the levels of three hundred and twenty-five and two hundred and twenty-one feet above the sea. From these it is distributed immediately by pipes for ordinary uses. The supply is estimated to be quite enough for the domestic consumption of a population nearly double that of Beirut. But it is probable, in view of the tastes and habits of the inhabitants of the East, that a large proportion will be required for ornamental fountains. The water reached the town in the early part of March last, and in June there were already hundreds of houses supplied with it. The Porte had made it a condition in the franchise that one-third of the capital should be offered to the people of Beirut, but there was but one native of the town who subscribed—a gentleman who is now the local director, a man participating in the more enterprising spirit of western countries. The people in general, probably, saw little difference between such an investment and one in their national loans: in which they never, at least not voluntarily, take a creditorrs position. English capital for the most part has supplied the means. The work has been conducted throughout to its completion by a British engineer, Mr. W. J. Maxwell, of Belfast. Natives, under European gang masters, were employed; except for the tunneling and machinery. The main tunnel is nearly eleven hundred yards in length, in which distance four shafts, the deepest being two hundred and thirty feet from the top of the rock, were sunk for the construction, allowing the horizontal piercing to proceed from ten faces at once. On this part of the construction, Italian as well as native laborers were employed, working night and day, and it was opened through in fourteen months. Mr. Maxwell, on the completion of the work, has returned to England. M. Briffeux, a very courteous French gentleman, is the superintendent at Dog River.

Beirut is even now an exceptional city in the East. It has various flourishing industries of silk, wool, cotton, iron and jewelry; with constant and increasing direct communication with Europe and America. The old narrow streets have in some quarters been widened. There are European hotels, pleasantly situated and well kept. There may be found a highly cultivated society from among the families of the merchants of various European countries, the clergy of various creeds, and the ladies and gentlemen connected with the missions for evangelization and schooling, whose headquarters for Syria are in the city. Reliable physicians, educated in Europe or at the medical college in Beirut itself, are at hand. For invalids seeking more complete change of scene, with a mild and healthful residence among agreeable surroundings, the place presents many attractions. Damascus is reached by diligence over a Macadamized road, recently made by a French company, and for those able to travel on horseback with a tent equipage, there are excursions to the Cedars of Lebanon, Baalbec, and on to the Holy Land, for which Beirut is a good starting point.

If the Euphrates Valley Railroad should be constructed, Beirut will probably become its terminus on the sea. When the British Government, in 1840. saw fit to maintain the sovereignty of the Porte over Syria, against the Egyptian dominion, the city was bombarded from an English fleet. It seems probable that the contrary policy will now be pursued, and that Egypt will be the ally in any of the struggles that may ensue. Whose *protection* it shall be that will be extended over Syria and Palestine may be more questionable.

The traveler in those countries even now feels that it is England, or more properly, the British empire of commerce that is "in the air;" far more than any other European influence. Berhaps the battle-cry "God for" Victoria, "England and St. George" may be soon shouted in the very plain close by Beirut and around the chapel, now a Moslem shrine, dedicated to his memory, where the warrior Christian had his celebrated tussle with the dragon monster.

Dr. Tyndall on Spontaneous Generation.

[From the London Athenaeum, January 15.]

On Thursday last Dr. Tyndall read a paper before the Royal Society "On the Optical Deportment of the Atmosphere with Reference to the Phenomena of Putrefaction and Infection," and surprised and gratified his hearers by communicating much more than was conveyed by his title. For he showed, by brilliant experiments, that spontaneous generation is an absolute impossibility, and that if solutions open to the air soon swarm with life, it is because they have been impregnated by living particles floating in the air. It has long been known that air which has been thoroughly freed from floating particles by fire, the action of acids, or otherwise, will not produce life; and further proof was given by Dr. Tyndall's researches in 1868 and 1869, with the additional facts that filtering through cotton-wool clears the air as effectually as fire, and that air thus purified will not transmit light. A glass chamber filled with the purified air remains dark, even when placed in the track of a concentrated beam of light. There is nothing to reflect or scatter the light; and it may now be accepted as an axiom that air which has lost its power of scattering light has also lost its power of producing life.

Hospital surgeons have been for some time aware of the fact that air which has passed through the lungs will not cause putrefaction. It has been filtered, and may be allowed to enter the veins without hurtful consequences.

The bearing of all this on the question of spontaneous generation is obvious. Pasteur has pronounced the spontaneity to be a chimera, and that, this being the case, it should be possible to banish parasitic or contagious diseases from the face of the earth; and, from this point of view, it is easy to see that the subject has a wide bearing on the phenomena of putrefaction and infection.

Dr. Tyndall now finds that air can be rendered optically pure by merely leaving it undisturbed three or four days in a close chamber. All the floating matter subsides, and the confined air will not transmit light. Solutions placed therein remain unaltered, though left for months, while similar solutions open to the ordinary air swarm with bacteria in twenty-four hours or two days.

The number and variety of Dr. Tyndall's experiments leave no room to doubt his conclusions. That they are of a high importence is manifest; but the believers in spontaneous generation will not accept them without a struggle. The publication of the paper itself will be looked for with interest.

The Generation and Characteristics of Smoke.

So much has been said and credited on the subject of the burning and combustion and even consumption of smoke; and it has been so often asked—What is smoke? that the subject must needs receive some attention, and we therefore produce the following interesting facts for the benefit of our readers:

The separate characteristics of gas and smoke will be made clear from the following—

"A tin vessel was prepared, in which was placed some small coal, resin, and tar, to produce a quick and large development of gas. The lid was removed, and an iron, made red hot, was introduced, and the vessel again close covered. A small tube was then inserted into the side of the vessel, to be blown into, as with a blow-pipe, to expel the gas in a stream through a nozzle on the opposite side of the vessel from the blowpipe. That the carbon in this gas is inaccessible, is proved by presenting a sheet of paper to the stream, and, although it may be slightly stained, if there be much tar present, no carbon however will be deposited. On this stream of gas (many inches long) being lighted, a lurid flame will be produced, but which, becoming cooled down before it can be sufficiently mixed with air, produces a large volume of true smoke. Here, then, is exhibited the gas, the flame, and the smoke, at the same moment, and in succession, just as they are produced in the furnace—the gas being converted into flame, and the flame into smoke.

"Now let us examine the characteristics of each. The carbon in the gas, as already mentioned, is inaccessible being concealed by or within the atoms of hydrogen respectively, and cannot be separated, or deposited on the paper. On being lighted, the hydrogen combines with the oxygen of the air forming steam, which flies off as already described. The result is, the liberation of the atoms of carbon, either to be converted into carbonic acid (if the heat can be continued), or deposited in the form of the fine lamp-black powder, as we see it collected on the wick of the tallow candle. This may be tested by presenting the white paper to it, when a large quantity of this black carbon will be deposited on it. We here see the double error of mistaking smoke for gas, and then assuming that the former can be burned.

"It may be wll ehere to notice an error with which we are generally impressed, namely, that the cloudy volume of smoke, as we see it issuing from a chimney and filling a large space in the atmosphere, is formed of carbonaceous matter.

"With equal propriety might we say, if we put a few drops of ink into a glass of clear water, and thus give it a blackened color, that the whole would become a mass of ink. This black cloud is merely the great mass of steam, or watery vapor, formed in the furnace, as already described, but colored by the carbon; and when we consider that no less than half a ton weight of water (in the expanded form of steam) is produced from every ton weight of bituminous coal consumed, we can easily account for the enormous volume and mass of this blackened vapor called smoke, as it appears to our vision, and the palpable error of supposing that this cloud of incombustible matter was capable of being consumed, or converted to the purposes of heat.

"Were it not for this mass of steam the carbon would soon fall, as a cloud of black dust; but, being intimately and atomically mixed with the large volume of steam from the furnace, it is carried along by the atmosphere, only differing in color, like the cloud of steam we see issuing from the chimney of a locomotive when in action.—*C. W. Williams, in Saward's Coal Trade Journal.*

A case has recently been decided in the Supreme Court of Louisiana which is of importance to oil dealers. A party in New Orleans advertised extensively that his oil was "non-explosive," and might be used with entire safety. A woman was led by these advertisements to buy the oil, and while using it the lamp exploded, severely injuring one of the family. Suit was brought for damages, and being decided in favor of the plaintiff in the lower court, was appealed to the Supreme Court of the State. A large mass of evidence on both sides as to the character of the oil was introduced, and the court decided that the defendant having advertised an oil as non-explosive and entirely safe was responsible for the results, and although the oil might really be the safest oil in the market, yet the fact that in this case it exploded rendered the seller liable. If the decision in this case is good law there is scarcely an oil manufactory in the country who cannot be held accountable for fire and personal injury, and the advertisements of even the best of oils should be very carefully worded.

Purification of Coke.—S. de Nomaison.—Description of a patent for desulphurizing coke, which consists in heating the coke out of contact with the air, so as to convert the sulphides into compound monosulphides, then treating with hydrochloric acid, which expels the sulphur as H_2S.

THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

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WEDNESDAY, FEBRUARY 16, 1876.

Correspondence

(Correspondents, in all cases, should sign their communications with their names and address in full—not for publication, unless desired, but as a guarantee of good faith.—ED.

The Lowe Process.

NEW YORK, February 7, 1876.
Room 87, Astor House.

Mr. Editor: Availing of your kind invitation to communicate facts developed by the Lowe process, allow me to preface my statement, by saying that its managers set out with an intelligent realization that it must stand wholly on its own merits, and have pursued the policy of referring direct to its daily practical operations, soliciting critical investigation on the spot. It is therefore quite a misfortune that they should, at a moment when the system was attracting much attention, have been deprived by an accident of their works at Utica, which constituted their best point of reference. As they assumed the entire cost of the test at that place, and it was deemed an experiment, the building was a temporary frame structure, unfit for such operations and liable to fire. The injudicious opening of a cap on the inlet to meter, by which a jet of gas was ignited directly against the wooden wall, insured its quick destruction Jan- 20th. The employee made a valorous attempt to close the valve, but was driven back severely burned, though fortunately, by shutting off connection with holder, he prevented worse consequences. The Utica Gas-Light Co. however, propose to give practical expression of their opinion of the principle, by the immediate erection of permanent works. The question of present interest to your readers, however, is what has actually been demonstrated in the building which was burned down on the 20th of January, and this I will try to answer.

On the 10th of May last, the Lowe apparatus began furnishing the entire supply for the city, under the courteous auspices of the Utica Company, and continued so doing until November 7, delivering during that period about fifteen million feet. During the first days of its distribution there were some complaints among consumers of stoppage of burners, but very careful examination of the matter found therein, and the fact of its entire disappearance for months since, have led to the belief that the new gas picked up and carried forward the particles deposited by the old, and this seems to be confirmed by the remarkable cleanliness of the drips ever since. The quality of the light is very fine, the flame being brilliant and exceptionally free from smoke, and there has been no difficulty in maintaining very close uniformity to a given candle power. It is certain also that this gas shows less shrinkage and less sensibility to extreme cold, than that made from coal.

On the 7th November, the Utica Co. having some 1500 tons of coal in stock, decided to utilize that amount of capital, and at the same time give employment to some old hands, thrown out of work by the new method, and from that date made about one third of the daily production.

This arrangement positively proved an important point, viz., the thorough mixture and diffusion of the diverse gases, but it continued the disadvantage which the new process has always labored under, from the limitation of its production. For example, such is its facility in gas making, that although four generators were set up, only two were required, and with even those, both time and material have ordinarily been wasted, because the holders were full. On one occasion when it was possible to make a continuous run of twenty-four hours, the labor of two men, (day and night) produced with two generators 176,000 cubic feet, using of coal, including boiler 9000 lbs., and of crude petroleum 550 gallons. This was an average of 4000 feet to each charge.

It has been found that an increased experience has developed improvements in several important features, so that even better results are obtained than when Prof. Wurtz made his investigation in October, At that time 3000 feet were produced for a 30 minutes run on a generator. Now 5000 feet are frequently obtained, and the average for December, despite the disadvantages above mentioned, was 3,594 feet. The same liabilities necessarily increase the coal item, for it appears upon exceptionally favorable days that the average consumption was reduced to about 50 lbs. to each 1000 feet. As it was 66½ lbs. in September, it is a fair inference that increased familiarity and larger scale of operation will enable the process to improve upon itself.

On December 20 we had stopped gas making temporarily, and opened the manhole in the washer, which is an iron tank 20 feet by 4 feet 6 in., partially filled with water, into which the superheater discharges. Having no vent cocks, there were foul gases in it which were ignited by a spark, either drawn over by the rush of air from the apparatus, or struck from the tool of the workman, and a concussion occurred, sufficient to bend the top plate. and thereby snap off all the inlet pipes. For the instant the apparatus was wholly inoperative, and the company's superintendent immediately ordered the benches fired, lest the city should be without light, but to the surprise of all it was running the next day, and the second day delivered nearly its average production. This is what the so-called "explosion" amounted to. On another occasion we fired up cold generators and ran gas from them in eight hours.

The wear and tear of the apparatus is very slight, and its solidity even enabled it to stand the fire of a fortnight ago, without injury. The works at Phoenixville, which have been in uninterrupted use for two years, appear as good as new.

It must be admitted that this process has done much toward a solution of that perplexing problem, so peculiarly important just now—how to produce an improved light at a reduced cost.

It would afford me pleasure to answer any further inquiries, and I doubt not Mr. Fish of the Utica Co. would also furnish any needed information.

Yours very truly,
GEORGE S. DWIGHT.

UTICA GAS-LIGHT COMPANY,
UTICA, Jan. 29, 1876.

GEORGE W. DRESSER, ESQ.,
Editor AMERICAN GAS-LIGHT JOURNAL.

Dear Sir: Having been confined at the house for some days will explain the delay in replying to your inquiries of the 25th inst.

The Lowe process was discontinued at the works of this company on the 19th of January, owing to the destruction from fire of the wooden building containing the apparatus.

The fire was caused by opening a four inch cap on the inlet to the station meter, without shutting off the gas from the holder. The foundations were of timbers supported on piles; these being consumed the machinery settled, and although in apparent good condition, it will not be safe to use without entire re building.

On the 20th of December an explosion occurred from a spark of fire from the "superheater," igniting the gas and air in washer, which the men had open and were cleaning. This broke the connecting pipes between the generating apparatus and washer; and although more or less gas was made each twenty-four hours by the Lowe works, it was not until the 10th of January that it was in condition to make its full supply for the city.

We commenced furnishing the entire supply of gas for the city from the Lowe works on the 12th of May, and so continued until the 7th of November, when we fired up nine retorts for the purpose of using up a supply of coal left over from the previous year; from the latter date until the fire, we made 25 per cent of coal gas, and 75 per cent. of the water and oil gas.

As soon as the season will permit, we propose to erect permanent buildings, and again manufacture the carburetted water gas as long as it proves as advantageous, as the experience of the past eight months has shown.

Yours respectfully.
W. P. FISH.

Gas-Light Intelligence.

United States.

Jersey City is now furnished with gas at $2.75 per thousand feet.

Hoboken now has to pay $3 per thousand feet for gas.

Gen. Marshall Lefferts has been elected Vice-President of the Equitable Gas-Light and Construction Co. *vice* Henry M. Martin removed.

The Despard coal mines, West Virginia, have forwarded for the Exposition a block of coal four feet square.

NEW HOLDER FOR CINCINNATI GAS WORKS.—Geo. Stacey & Co. were the lowest bidders for the new holder to be built for Cincinnati Gas Co. this season, and the contract has been awarded to them.

GAS LEGISLATION.—By Mr. Peabody—Calling on the New York gas companies for a financial report, showing a true statement of their business, embracing their incomes, dividends, and investments.

We are informed that the Westmoreland gas coal is offered at $6 per ton by the cargo, delivered here this season, and that the Youghiogheny miners have offered to meet this price. This is very low, 50 cents less than in 1875, and $1.25 per ton less than in 1874. The fact is, the railroads will have to reduce transportation rates on coal.—*Coal Trade Journal.*

NATURAL GAS IE ST. LOUIS.—The St. Louis *Commercial Gazette* says; During the past week considerable excitement was developed over the accidental discovery of a well of natural gas, on the premises of the St. Louis Cotton Compress Company. A company was immediately organized for the practical utilization of this god-send, and steps taken to convert it into use for fuel and illuminating purposes.

The *American Manufacturer* suggests that "the fuel of the future in the varied manipulation of the rolling mill will undoubtedly be gas. The question

awaiting solution is the form of furnace which will be used. For the present, at least, in old works, and especially where bituminous coal can be procured at a low figure, the cost of Siemens will stand in the way of its introduction. In such works the aim will be to get some method by which the old furnaces can be fixed with little or no alteration."

FIRES FROM KEROSENE.—On January 31st a serious fire occurred in Brooklyn, corner of Atlantic and Nevens streets, caused by the dropping of a match near a barrel containing kerosene, which resulted in the destruction of the store. and damage to three adjoining buildings. The total loss was $16,000.

On Feb. 10, by the explosion of a kerosene lamp a house in Elizabeth, N. J., took fire, and was almost destroyed. the inmates escaped. The loss is about $1,000; fully insured.

Canada.

In a case of fatal gas asphyxiation in Quebec on the 10th ult., the jury express the opinion that the breakage in the main pipe was caused by the pipe being insufficiently supported in consequence of having been undermined by the Corporation in laying the water and drainage pipes. They recommend that the Corporation and Gas Company be urged to open up the street for making a thorough inspection of their respective works in that locality, and to adopt such measures as will protect the public from similar accidents in the future. They also ask the government to appoint a gas inspector for the city. The corporation engineer repudiates any responsibility in connection with the accident, the water and drainage pipes having been laid twenty years ago in the locality where the accident occurred.

Great Britain.

THE GAS AND WATER COMPANIES AND THE STREETS.—Mr. C. W. Merrifield has lately drawn attention to the trite grievance, which affects alike the comfort and the pockets of the lieges, and to some extent the public safety, occasioned by the continual opening up of the streets for the purpose of laying and repairing gas and water pipes. The companies' workmen never leave the roads in as good a state as they find them in; and after a partial disturbance they cannot be relaid properly; there is always a ridge, awkward, unsightly and dangerous over the pipes. The fault rests mainly with the local authorities, and the contractors, who have great influence in a small way, have doubtless some share in keeping up a state of things which enables them to prey upon the public; but Parliament is most to blame for hesitating to replace the old, effete, vestries with efficient municipal institutions, which shall possess a power and prestige sufficient to check the companies and their contractors. Mr. Merrifield makes a noteworthy statement regarding the gas companies which is worth repeating. "We all know," he says, "that the gas companies objected to use the subways, even when provided for them, choosing rather to break up the roads and lay their pipes in the dirt, where they could not be got at, instead of in the subways, where they could"—preferring to allow the pipes to leak into the earth; whereas in tunnels they must have been provided with gas-tight joints. As it is, the gas frequently escapes into cellars and other places, and occasions dangerous and sometimes fatal explosions and other mischief. Several fine old trees in Piccadilly, for instance, are said to be perishing, owing to the saturation in this way of the soil in which they grow.

France.

The revenue of the Parisian Company for Lighting and Heating by Gas amounted in the first ten months of 1875 to £1.304,440, showing an increase of £112,-211 or 9.41 per cent. as compared with the corresponding period of 1874.

Virginia City, Nevada.—The new water works for Virginia City will not be completed before June, 1876. The cost will be $130,000.

Chemical and Scientific Repertory.

RENDERING WOOD INCOMBUSTIBLE.—M. Jones.—The wood is impregnated with sodic tungstate.

NEW MODE OF PRESERVING WOOD.—M. Lostal.—Soaking in lime-water is the method employed.

QUANTITY OF WATER CONSUMED BY GRAIN DURING ITS GROWTH.—M. Davy.—For the soil of Montsourie 1·820 parts of water are required for 1 part of grain. With the soil and the fertilizer used this proportion varies, being under some circumstances even as high as 4 to 1.

WATER-PROOFING GOODS.—M. Parone.—Eight litres water are heated to 80° C., and a mixture of 300 grms; gelatine, and 600 grms. castor oil soap introduced, and then 300 grms. of gum lac. The fire is then withdrawn and 600 grms. of finely pulverized alum introduced, little by little, to insure complete solution. The solution thickens, giving a mixture which may be applied to fabrics with a fine brush, rendering them waterproof.

PROCESS OF TANNING SKINS TO RENDER THEM SUPPLE.—M. Pudsiler.—The skins are impregnated with alum, dried, and then treated with a composition of resin, tallow, and some hydrocarbons. What will dissolve is then washed out with water, leaving the skins well cured and supple.

TEST FOR SULPHO-CARBONATES.—M. Mermet.—Any ammoniacal salt of nickel produces a rose tint in the presence of 1-60 thousandth part of any sulpho-carbonate.

APPARATUS FOR THE MANUFACTURE OF ILLUMINATING GAS from mineral oil, tar, fatty and oily substances, and from the waste waters of manufactories of carded wool and cloth.—F. Kuchler.—This consists essentially in the introduction of hydrogen into the retort, which, it is claimed, unites with the carbon, which otherwise deposits as gas carbon.

GAS FROM CORK.—Cork waste, or trimmings and clippings from the manufacture of cork stoppers, is said to constitute about 70 per cent. by weight of the raw material. M. Dalma, of Bordeaux, has recently tried some experiments on the manufacture of gas from this otherwise waste product. The yield in gas was found to be 50 cubic metres from 100 kilos. The illuminating power was equal to that of 36 standard candles.

PREPARATION OF A LIME SOAP WITH THE FATTY WATERS OF FULLERS' ESTABLISHMENTS, and use of this soap.—E. Lehwanborn.—The most profitable use to which the lime soap can be put is stated to be the manufacture of illuminating gas by destructive distillation. Comparative tests showed as follows:

Raw Material.	Amount of gas obtained in cubic metres per quintal of raw material.	Illuminating power.
Coal	20·998	9.
Wool suint	21·000	27·5
Stearine tar	19·760	29·3
Lime soap	33·677	32 3

The distillation is also much more rapid, and the retorts are left cleaner, than in the case of coal. The amount of fuel required to distil the lime soap is one-fourth less than for coal.—E. W.—*Amer Chemist.*

DALTON'S LAW, AND THE CONSTITUTION OF THE ATMOSPHERE.—It is well-known that the famous law of Dalton, with reference to the diffusion and independent existence of aqueous vapor in the atmosphere, has exerted a very strong influence in molding the views of meteorologists as to the method by which this portion of the atmosphere operates in modifying atmospherical phenomena. Of late years, however, some very strong suspicions have existed as to the propriety of carrying Dalton's views to the extreme that has been maintained by many. In fact, so early as 1840, Espy distinctly controverted them. Of late, Hildebrandsson, Hann, and especially Stefan, have more correctly explained the limitations within which Dalton's laws may be applied. According to the latter, these obtain in the case of a mixture of gases only under conditions of static equilibrium, and do not hold when these are in motion. Since the vapor of water in the air, in consequence of its continual evaporation and condensation, is always in movement, it does not conform to Dalton's laws. The permanent gases of the atmosphere, oxygen and nitrogen, which retain in general the same proportions, are in equilibrium, and do form atmospheres independent of each other, according to Dalton's laws. It necessarily follows that the percentage of dense oxygen must be smaller as we ascend in the air; and, in fact, chemical analysis gives this result.—*N. Y. Tribune.*

Early Gas-Lights.

The following is taken from a copy os the *Columbian Phenix*, published in Providence, R. I., November 27, 1813:

The ſubſcribers, Proprietors of Letters Patent from the Preſident of the United States, for the IMPROVED GAS LAMP, for lighting Manufactories, Mines, Mills, Theatres, Light Houſes, and other Buildings, with Hydrogen Gas, or inflammable air, produced from Pit Coal, in a more agreeable, more ſafe, and leſs expenſive manner than has hitherto been done by any other method, having it now in operation in a buiding in Newport, R. I. and in the Cotton Manufactory of Mr. *Seth Bemis*, in Watertown, (seven miles from Boſton) which is now brilliantly illuminated every night with Gas Lights, to the excluſion of every other artificial means, they reſpectfully invite gentlemen concerned in manufactories, &c. to call and view it in operation, and be convinced of the utility and advantages of this improvement. The Gas apparatus is very ſimple in its conſtruction, and if ſo eaſy in its management, that any perſon of ordinary faculties may be taught in one or two operations, to manage every part of it effectually; and the trouble will be found infinitely leſs than that of trimming and tending lamps or candles to afford the ſame number of flames.

The Gas Lights are in no way offenſive, but very agreeable to the eye, and will be found extenſively uſeful in every ſituation where much light is required, eſpecially in *Cotton* Manufactories, inasmuch as they are leſs expenſive than thoſe from tallow or oil, and free from the inconvenience and danger reſulting from the ſparks and frequently ſnuffing of lamps and candles; circumstances tending greatly to diminiſh the hazard of fire, and proportionably to reduce the rate of inſurance on buildings and materials ſubject to that deſtructive element.

Contracts will be entered into for furniſhing and putting up the apparatus in manufactories, &c. immediately, on terms highly advantageous to them. by applying to

DAVID MELVILLE, *Newport*, or
WINSLOW LEWIS, *Boston.*

November 18.

N. B. The Gas Apparatus has juſt been erected under the ſuperintendence of the Patentee, at the WENSCUTT MANUFACTORY, (one and a quarter mile from the Mill Bridge) which is now illuminated every Evening with Gas Lights. Gentlemen concerned in Manufactories in this vicinity, are reſpectfully invited to call and ſee this valuable improvement in operation. An Apparatus for any number of lights can be furniſhed in ten days after application as above.

Providence, Nov. 13th, 1813.

Gas Testing in Edinburgh.

The committee recently appointed by the Town Council of Edinburgh to investigate the gas supply, have had fitted up in the office of the city analyst (Mr. J. F. King) apparatus worked on the most approved scientific principles. All sunlight is excluded

from the testing room, and the walls are painted black. Two distinct tests are employed, one for illuminating power, and the other for purity. In the first of these the standard with which the gas is compared is that of a sperm candle, which is estimated to burn at the rate of 120 grains per hour. The candle as it burns is weighed with a delicate self-acting balance, and necessary corrections made from the time required to burn 120 grains of sperm. Allowing for the pressure and temperature, which is 60 deg. Fahrenheit, and the standard pressure 30 inches of mercury. The passage of the gas to the test jet is equalised by pressure governors, and checked by a delicate meter which indicates to the hundredth part of a cubic foot. The apparatus used for testing the illuminating power, may be described as an oblong box divided into three compartments—a small one at either end for the standard candle and gas jet, and a longer one in the centre. In this latter is placed a bar having engraved upon it a graduated scale, with the zero at equal distance from the gas jet and candle. A small moveable box on wheels, and containing a disc accurately showing the shadows thrown by the gas-jet, passes along the bar. A view of both sides of the disc is obtained by two mirrors nicely adjusted, and thus the shadows cast by the candle and gas-jet are visible at the same time. The box containing the disc is moved along the bar until it is found that the shadows cast by the gas and candle exactly balance each other, and the point on the index bar at which this correspondence is observed gives the illuminating power of the gas expressed in standard candles. This experiment is repeated ten times to allow a fair average. To ascertain the purity of the article or to detect the presence of such dangerous elements as hydro-sulphuric acid, carbonic acid or ammonia, the gas is passed through a small glass chamber, rendered air-tight by placing it in a bath o mercury. Test papers are suspended on hooks in this chamber, and the gas streaming against these papers the nature of the impurities is detected by the chemical reactions which ensue.

The production of petroleum in Canada for 1875 has averaged about 1000 barrels per day, and this is nearly double the requirements of the Dominion for consumption. The refining capacity of the country is ten times greater than the consumption, and five times greater than the production. Crude oil on the 8th of January was 85 cents a barrel, and refined 23 cents per gallon. The quality of the oil is so inferior as to make it impossible for it to compete with the Pennsylvania oil, especially while the price of the latter is low, and altogether the oil trade in Canada does not look very cheery.—*Exchange.*

American Patents.

Patents issued for week ending Jan. 4, 1875.

	Class.	Number.
Burner for Gas Stoves—T. J. Kelley (re-issue), New York; filed Aug. 18, 1875	64	6,833
Gas Burner—O. J. McGann, Chicago, Ill.; filed Nov. 16, 1874	64	171,831
Gas Stove—W. M. Jackson, Providence, R. I.; filed Nov. 13, 1875.	65	171,814

Patents issued for week ending Jan, 11, 1876.

Gas Burner—W. C. Wren, Brooklyn, N. Y.; filed Octobor 19, 1874	64	172,065
Regulator for Gas Burner—C. G. & G. Curtis, Bridgeport, Ct.; filed November 12, 1875	64	172,000
Gas Governor—D. Bruce Peebles, Edinburgh, Scotland; filed October 8, 1875	64	172,163
Illuminating Gas Manufacture—G. Olney, Brooklyn, N. Y.; filed April 24, 1875	66	172,047
Centrifugal Gas Purifier—P. Sweeney, New York; filed December 24, 1875	66	171,963

Patents issued for week ending Jan. 18, 1876.

Manufacture of Gas—George Olney, Brooklyn, N. Y.; filed November 27, 1875	66	172,474
Air and Gas Carburetter—Porter & Grimes (re issue). N. Y.; filed December 18, 1875	27	6,865

Patents issued for week ending Jan- 25, 1576.

Process and Apparatus for Manufacture of Gas—E. H. Covel (re-issue) New York; filed Jan. 20, 1876	66	6,878
Gas Regulator—Rehn & Ford, Philadelphia; filed Oct. 8, 1875	64	172,774
Gas Regulator—D. Bruce Peebles, Scotland; filed Oct. 8, 1875,	64	172,768
Gas Regulator and Purifier—Booth & Esser, Manch Chunck, Penn.; filed July 10, 1875	64	172,696

Gas Stocks.

Quotations by W. B. Scott & Co., Bankers,

24 Pine Street, New York City.

February 16, 1876.

☞ All communications will receive particular attention

	Capital.	Par.	Bid.	Asked
Gas. Co.'s of N. Y. City.				
Harlem	$1,850,000	50	132	134
Manhattan	4,000,000	50	295	300
Metropolitan	2,500,000	100	160	163
" Scrip		..	104	105
Mutual	5,000,000	100	109	110
New York	4,000,000	100	150	153
Central, Westchester	466,000	50	100	105
Gas Co.'s of Brooklyn.				
Brooklyn	2,000,000	25	205	210
Citizens	1,200,000	20	100	105
" Scrip		...	100	101
Peoples	1,000,000	10	70	75
" Bonds		...	96	98
" Scrip		...	95	98
Metropolitan	1,000,000	100	70	80
Nassau	1,000,000	25	100	103
Williamsburgh	1,000,000	50	—	143
" Scrip		...	100	102
Out of Town Gas Companies.				
Buffalo Mutual, N. Y	750,000	100	50	50
Baltimore, Md	2,000,000	100	190	...
Brockport, N. Y	25,000	...	...	85
Citizens, Newark	500,000	...	70	75
Derby of Conn	160,000	100	...	80
East Boston, Mass		25	112	115
Hannibal, Mo	100,000	100	58	60
Hartford, Conn	700,000	25	41	43
Hempstead, L	40,000	100	...	100
Jersey City	386,000	...	160	...
Jamaica, L. I	25,000	100	...	100
Jacksonville, Ill	120,000	50	80	90
Lewistown, Maine	400,000	100	...	75
Lima, Ohio	60,000	100	10	...
Laclede, Mo			...	123
Peoples, Jersey City		...	130	140
Peoples of Albany	1,000,000	100	31	40
Peoples of Baltimore		25	198	...
Rochester, N. Y		100	50	...
Richmond Co., S. I.	300,000	...	100	105
Fort Wayne, Ind		100	...	105
Woonsocket, R. I	150,000	100	100	...
Halifax N. S	400,000	40	148	150
Hamilton, Ontario	150,000	40	112½	

PRICES OF FOREIGN AND DOMESTIC GAS COALS.

[Reported Expressly for this Journal.]

[February 16, 1876.
DELIVERED IN NEW YORK.

English Cannel.

Ince Hall	$17 00	@	18 00
Kirkless Hall	16 50	@	17 00

English Caking Coals.

Newcastle Gas	$5 50	@	00 00
Liverpool caking	11 50	@	12 00

British Province Coals.

Pictou			2 00
Block House—At Mines, $1.87, Gold			2 00
Caledonia—At Mines, $1.50, Gold			0 00
Little Glace Bay—At Mines, $1.75, Gold			0 00
Lingan—At Mines, $1.75, Gold			0 00
Sydney—Old Mine			5 00
" Reserve, $1.75, Gold Mine			0 00
" International			— —

Duty, 15 cents per ton, gold. Freight to New York $2 00 currency. Cost of above coals delivered in New York, $4 75 @ $5 00, currency.)

Pennsylvania Coals.

Penn Gas Coal—At Amoey	$5 60	@	0 00
Westmoreland—At Amboy	5 60	@	0 00
(In New York both the above coals $6 00)			
Shafton	6 50	@	0 00
Youghiogheny	6 00	@	0 00
Waverly	6 00	@	0 00

West Virginia Coals.

MurphyRun	$6 50	@	0 00
Despard	6 50	@	0 00
West Fairmont	6 50	@	0 00
American Gas Coal	7 40	@	0 00
Fairmont	6 50	@	0 00
Newburgh Orrel	6 50	@	0 00
Pinnickinick	6 50	@	0 00
Cloverhill of Virginia	6 00	@	6 50
McKenzie Compound Mixture			— —

American Cannel Coals.

Peytona of West Virginia	$12 50	@	00 00
Darlington of Pennsylvania			— —
Cannelton Cannel			11 00
Red Bank—at Philadelphia			6 50
" —at South Amboy			7 25

Asphalts.

Albertite of New Brunswick	$21 00	@	— 00
Trinidad Bitumen	— —	@	14 00

The Penn Gas Coal Company have contracted with the Pittsburgh Gas-Light Co. for their entire supply for th ensuing year from their Youghiogheny mines.

Within the last week contracts have been made by some of the companies in New York for about 200,000 tons of Penn, Westmoreland, Waverly, Youghiogheny, and the West Virginia caking coals—at $6·00 per ton a reduction of 50 cents from last years' prices.

TO GAS COMPANIES, AND CITY GOVERNMENTS.

DYOTT'S PATENT CHAMPION STREET LAMP

Doubles the Light with the same quantity of Gas used in other Lanterns. *All others* waste half their light, illuminating the sky, or if the top s of metal, absorb it.

Single Top Glass Lamps both Globular and Square become heated if a good light is put in them, and rain, hail or snow falling upon the heated glass breaks it. When one glass is broken the wind will either blow the flame against the others and break them, or destroy the entire Lamp. *Nine-tenths of the breakage and cost of repairs of other* street lamps is owing to that cause.

Dyott's "Champion" is the only double top—the only Lamp that has the Opaline White Dome, which is a *never changing reflector;* it doubles the power of, and throws the light to a greater distance. It is also a perfect *protector,* shielding the heated top or the lamp from all inclemency of the weather. The white dome is kept cool by the passage of air between it and the transparent globe below. Rain, hail or snow will never break either the globe or dome. The globe rests upon rubber cushions, and is supported laterally by elastic springs, so that contraction or expansion of the globe, or jarring of the post will not break it. They can be cleaned in one-fourth the time required to clean other lanterns. The metallic portions are of iron, copper and brass, and are the most durable, economical, efficient and cheapest lamps in existence. For public buildings, and wherever an ornamental and powerful light is required, they are made in clusters of 2, 3, 4, 6, 7 and 10 lamps, which have no equal in this or any other country for *beauty, durability, efficiency* and economy, either in cost, use or ornamentation. Designs furnished when requested for specific purposes. Gas companies, or those who have the lighting o Cities in charge, are solicited to communicate with us in reference to the agency for its introduction.

The Franklin Institute has awarded our Champion Lamp the highest premium: (they give a silver medal) and its Committee on Science and the Arts has recommended it as the best lamp in use. It has also invariably taken the highest premium at every Exhibition at which it has been presented, and elicits the strongest commendations wherever it is used. We have several new and handsome patterns of Posts for Corporations, Parks, public and private use, also for clusters of lamps, that are not excelled in beauty or price at which hey are furnished.

DYOTT MANUFACTURING CO.,
574 6meot 114 South 2nd Street, Phil'a, Pa.

THE LOWE GAS PROCESS.

S. A. STEVENS & CO.,

SOLE AGENTS.

ROOM 87, ASTOR HOUSE.

P. O. Box 1110, NEW YORK.

AND

400 430 Walnut Street, Philadelphia.

TO GAS-LIGHT COMPANIES,

A **practical gas man wishes to purchase** or Lease

A Small Gas Works,

making from 3,000 to 10,000 cubic feet of Gas per day. Address, with full particulars, HENRY PORTER,

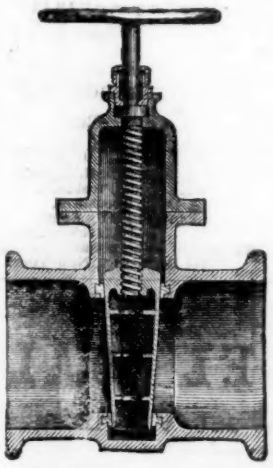
409-2t Sup't Gas Works, Cold Spring, N. Y.

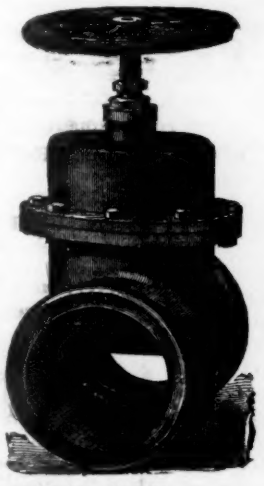
CHAPMAN VALVE MANUFACTURING CO.

MANUFACTURERS OF

CHAPMAN GAS VALVES.

Office and Sales Room 75 and 77 Kilby Street, Boston.





These Valves have been in use for several years, and are pronounced by all who have used them to be

The Best Gas Valves Ever Made.

They afford a direct passage the full size of the pipe. The seats are made of an alloy similar to BABBITT metal, specially prepared for the purpose, and superior to all other metals used for the seats of Gas Valves. It does not corrode under any circumstances to which it is exposed.

There is no LIABILITY OF COHESION between the Gate and Seat, and the Valves can be relied upon to SHUT TIGHT and OPEN EASILY at all times—an important desideratum when used for street mains, in cases of fire.

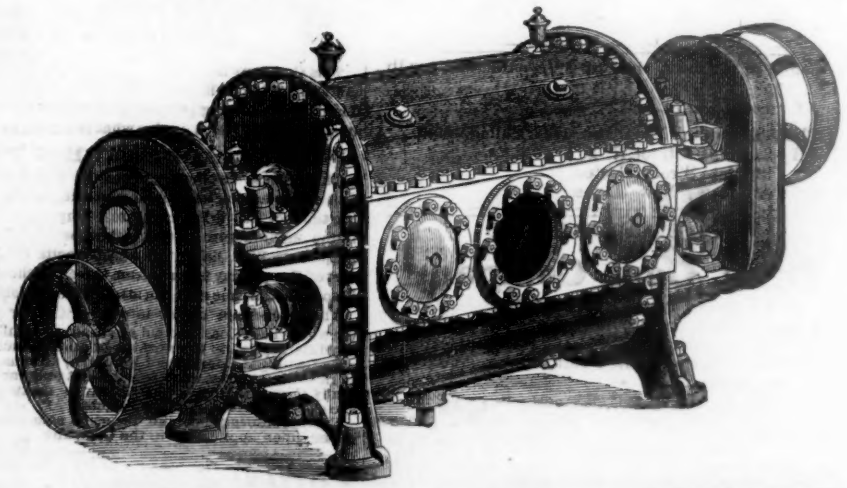
We refer to the following named Gas-Light Companies among the many that have used these Valves:

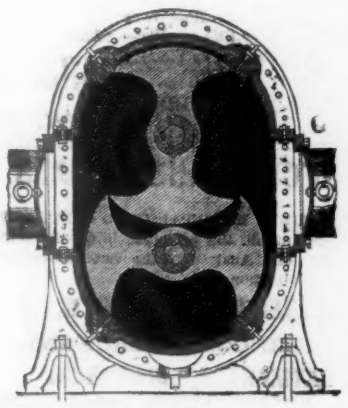
BOSTON GAS-LIGHT COMPANY, BOSTON, MASS.
CAMBRIDGE GAS-LIGHT COMPANY, CAMBRIDGE, MASS.
NEWTON & WATERTOWN GAS-LIGHT CO., WATERTOWN, MASS.
LAWRENCE GAS-LIGHT COMPANY, LAWRENCE, MASS.
PEOPLES GAS-LIGHT COMPANY, BROOKLYN, N. Y.
CITIZENS GAS-LIGHT COMPANY, BROOKLYN, N. Y.
SOUTH BOSTON GAS-LIGHT COMPANY, BOSTON, MASS.
CHARLESTOWN GAS-LIGHT CO., CHARLESTOWN, MASS.
LYNN GAS-LIGHT COMPANY, LYNN, MASS.
FITCHBURG GAS-LIGHT COMPANY, FITCHBURG, MASS.
CITIZENS GAS-LIGHT COMPANY, NEWARK, N. J.
WILLIAMSBURGH GAS-LIGHT CO., WIRLIAMSBURGH, N. Y.

GAS AND WATER VALVES ½ INCH TO 36 INCHES DIAMETER.
STEAM VALVES ½ INCH TO 12 INCHES DIAMETER.

357-tf

PATENT IMPROVED GAS EXHAUSTER.





P. H. & F. M. ROOTS, PATENTEES AND MANUFACTURERS, CONNERSVILLE, IND.
S. S. TOWNSEND, GENERAL AGENT, 31 LIBERTY STREET, NEW YORK.

The following are some of the advantages we claim for this Exhauster over all others:

FIRST.—It is simpler in its mechanical construction than any other Exhauster in use.

SECOND.—The internal parts consist of only two revolvers, each cast entire in one piece, without a single screw, bolt, nut, washer, key or other part to get loose on the inside and stop or break the machine. The internal operating parts, therefore, can not get out order and hence require no care or attention.

THIRD.—Every part of the machine requiring care or attention, as the journals, gearing, etc., is external, easily observed and attended to. All changes, adjustments, and repairs are made from the outside. The journal bearings, if necessary, can be renewed in a few minutes.

FOURTH.—The internal operating parts are practically gas-tight, but are not in actual contact, hence there is no internal friction or wear. The machine is therefore operated with less power than any other.

FIFTH.—They are built in the most complete and substantial manner, with steel shafts and improved journal bearings, and their durability is almost without limit.

We build them of any required capacity, large or small, adapted to any kind of works or place.

Send for Illustrated Catalogue, giving all particulars as to capacity, speed, power required, dimensions, and price of each size and references to parties using them.

P. H. & F. M. ROOTS.

GAS COALS.

THE
PENN GAS COAL COMPANY

OFFER THEIR

COAL, CAREFULLY SCREENED,

AND PREPARED FOR

GAS PURPOSES.

Their Property is located in the Youghiogheny Coal Basin, near Irwin's and Penn Station, on the Pennsylvania Railroad, and on the Youghiogheny River.

OFFICES

No. 11 Merchants Exchange, Phil'a. 90 Wall Street, New York.

PLACES OF SHIPMENT.

Pennsylvania Railroad, Pier No. 2 (Lower Side).
Greenwich Wharves, Delaware River.
Pier No. 1 (Lower Side), South Amboy, N. J.

366-1y

CANNELTON COAL CO.

OF WEST VIRGINIA.

Offer for sale the following Coals, from their Colliery at CANNELTON, Kanawha County, West Virginia, delivered at RICHMOND, Va.:

CANNELTON CANNEL.

cknowledged to be the most valuable ENRICHER produced in this country, a gross ton yielding 10,000 ubic feet of GAS of 64·54 CANDLE POWER; COKE 32 bushels, of good quality.

CANNELTON CAKING COAL.

Volatile Matter.	Coke.	Per cent. of Ash in		Sulphur in			Specif. Gravity.	
		Coal.	Coke.	Coke.	Oötl.	Volatile Matter.	Coal.	Gas.
35.1	64.9	2	6	.82	1.48	.66	1,289	.476

MAXIMUM YIELD, 5.06 cubic feet of Gas per pound of Coal—A yield of 4·78 cubic feet per lb.—gave 16 14-100 Candle-Power.

COKE, of very fine quality—1453 pounds produced from one ton of coal.

SALES AGENTS { J. TATNALL LEA, Treasurer, P. O. Box 1747 Philadelphia. / PERKINS & JOB, 27 South Street, N. Y.; 91 State Street, Boston. / H. W. BENEDICT & SON, New Haven.

SCOTCH CANNEL COALS.

THE SUBSCRIBER IS PREPARED TO CONTRACT FOR the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

JAMES McKELVIE,

CANNEL COAL MERCHANT,

HAYMARKET, EDINBURGH.

ESTABLISHED 1840. 357-1y

WREN'S GAS WORKS.

W. C. WREN,

Corner of Jay and Water Streets,

BROOKLYN, N. Y.

HAVING GRANTED THE USE OF ONE OF my Patents to the Gas-Light Company of America, and settled my claim against them, I inform the profession that I continue to erect the Works known as

Wren's Gas Works,

and sell Licenses to use my Patents for making Gas from Petroleum.

Gentlemen of the profession:—As your consumers demand a better light, and as that demand has been in many cases sought in vain to be met by using different abortive imitations of my various processes, would it not be well to make success sure by trying the plan of the inventor.

You can enrich your Coal Gas to any desired standard, by using my process, in the simplest manner, and much cheaper than by *any other* method. Address as above. 397

THE NEWBURGH

Orrel Coal Company,

Mines at Newburg, Preston County, W. Va.

Company's Office, No. 52 S. Gay Street, Baltimore, Md.

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Best dry coals shipped from Locust Point, wharves, and prompt attention given to orders for chartering of vessels.

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351-1y

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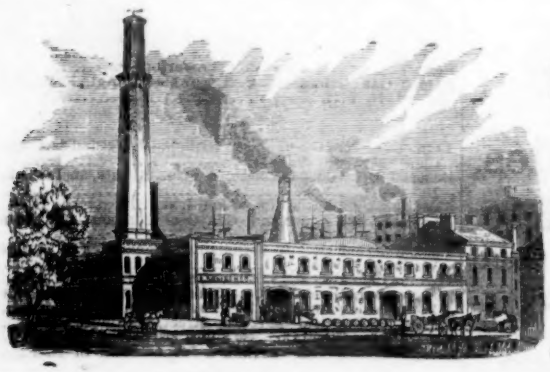

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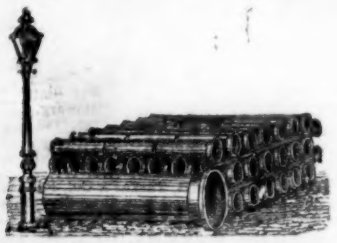

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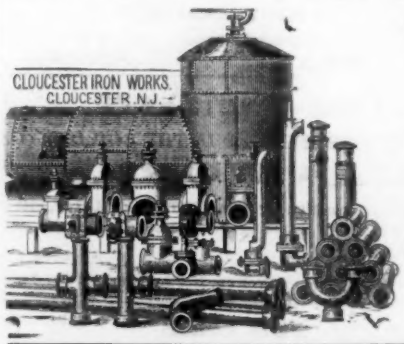

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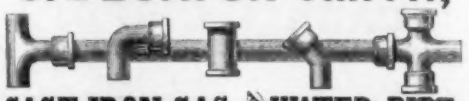

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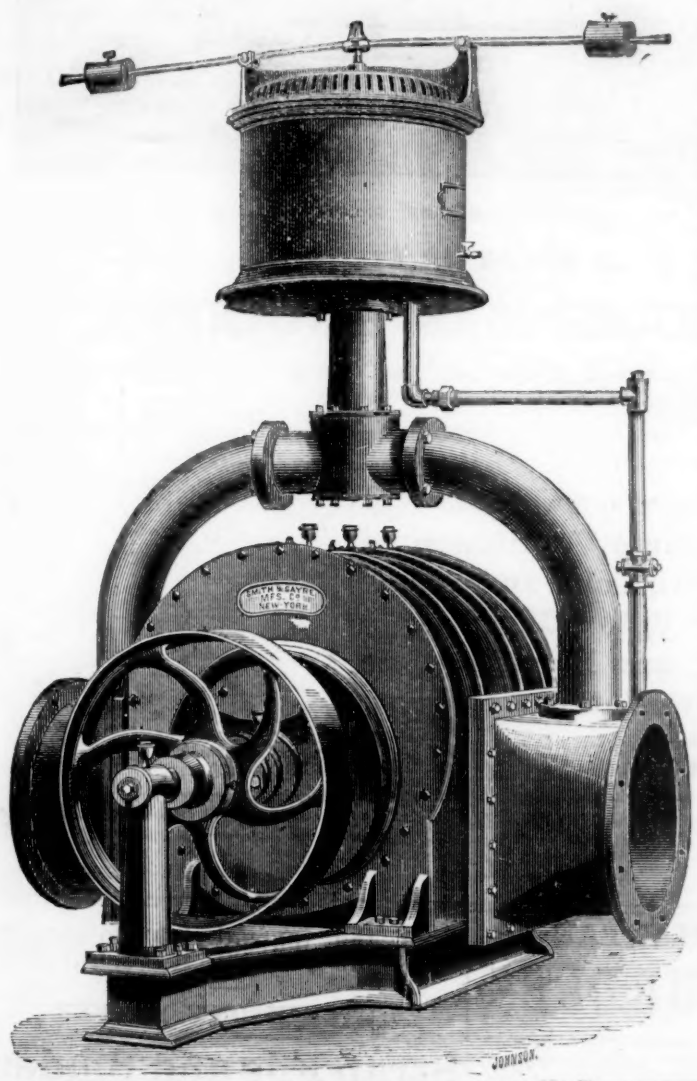

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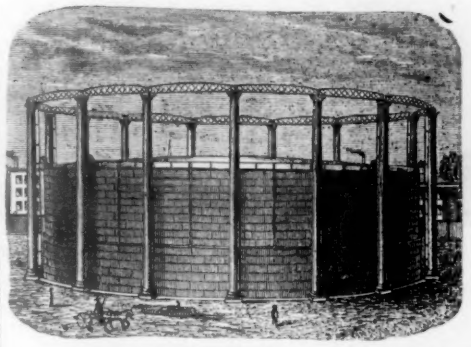

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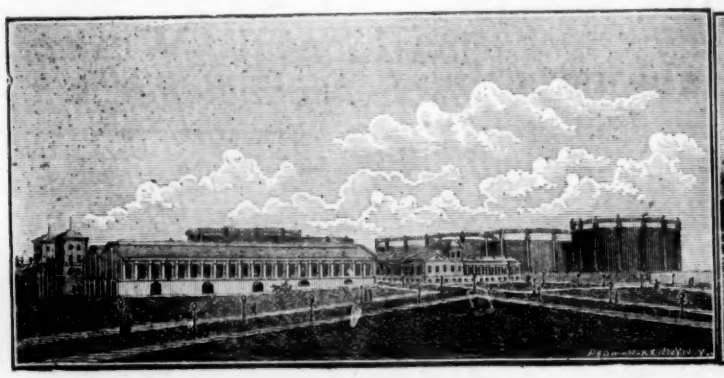

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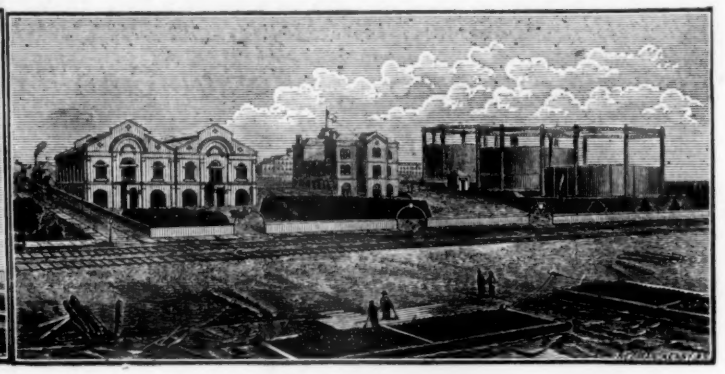

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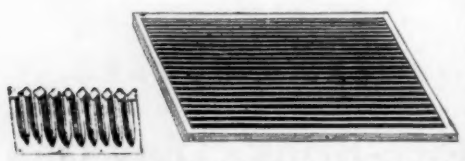

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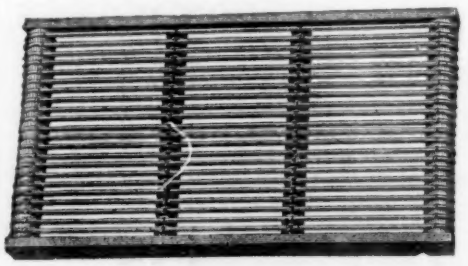

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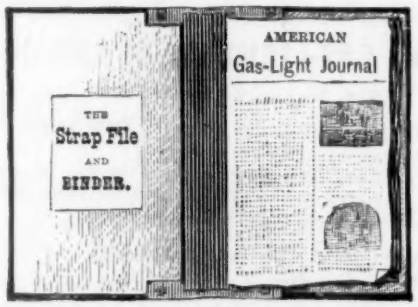

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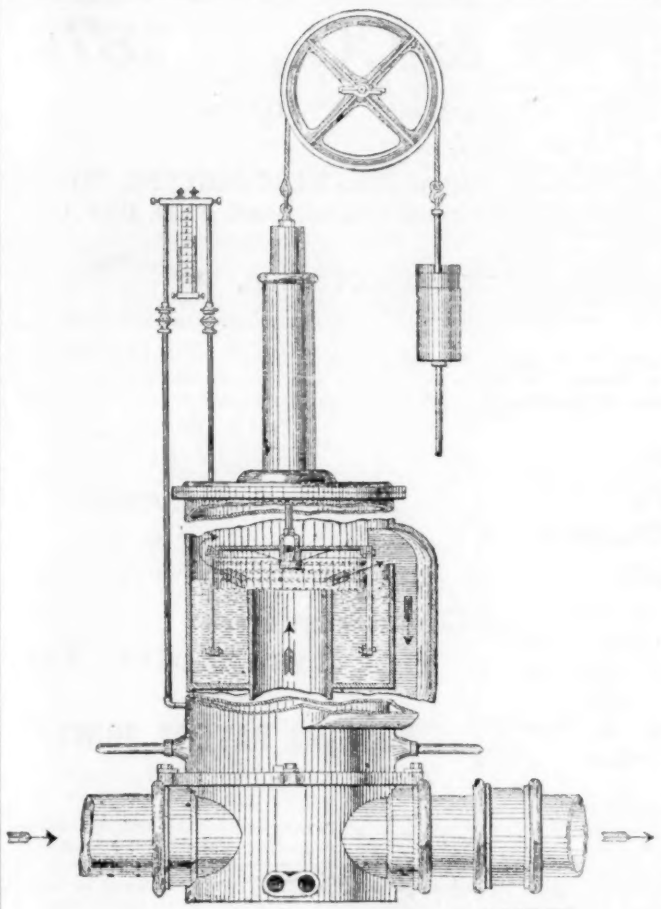

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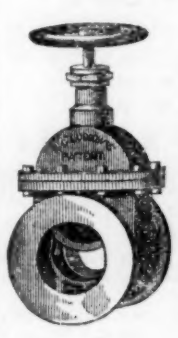

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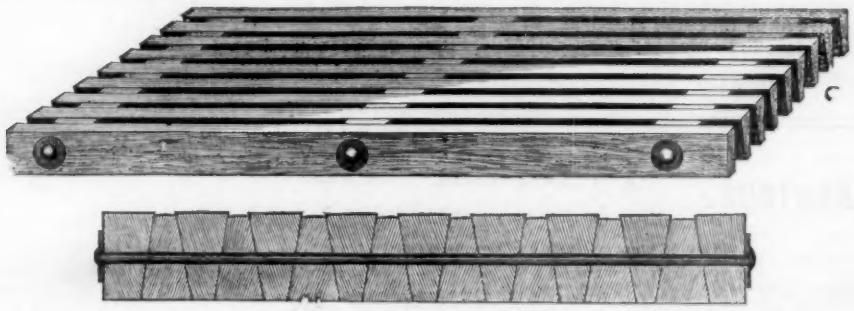

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Rahway Gas-Light Company, N. J.
Trenton Gas-Light Company, N. J.
Elmira Gas Company, New York.
Erie Gas Company, Pa.
Columbus Gas-Light Company, Ohio,
Westchester Gas-Light Company, N. Y.
Santa Cruz Gas Company, Cal.
Lawrence Gas-Light Company, Kansas.
Salem Gas Company, N. J.
Indiana Gas-Light Company, Pa.
Peoria Gas Company, Ill.
Montclair Gas Company, N. J.
Williamsport Gas Company, Pa.
Wooster Gas-Light Company, Ohio.

Augusta Gas Light Company, Ga.
Hunts[illegible] Gas Company, Ga.
Chattanooga Gas Company Tenn.
Murfreesboro Gas Company, Tenn.
Hagerstown Gas-Light Company, Md.
Hanover Gas Company, Pa.
Easton Gas Company, Pa.
Uniontown Gas-Light Company, Pa.
Coatesville Gas-Light Company, Pa.
Houston, Gas Company, Texas.
Wilkesbarre Gas Company, La.
Middletown Gas Company, New York.
Washington Gas-Light Company, Pa.
Princeton Gas-Light Company, N. J.
Newark Gas Company, Ohio.
Pontiac Gas-Light Company, Mich.
And numerous other Companies.